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The Western Electric Company is an integral part of the Bell System. Its purpose is to provide a dependable supply of telephone equipment of high quality at low cost. The Western Electric plan of centralized manufacturing tric plan of centralized manufacturing and distributing has half a century of and distributing has half a century of proved benefits behind it. The increase proved benefits behind it. The increase of the telephone and the need for continued progress make it more important to the public than ever before.

BELL TELEPHONE SYSTEM



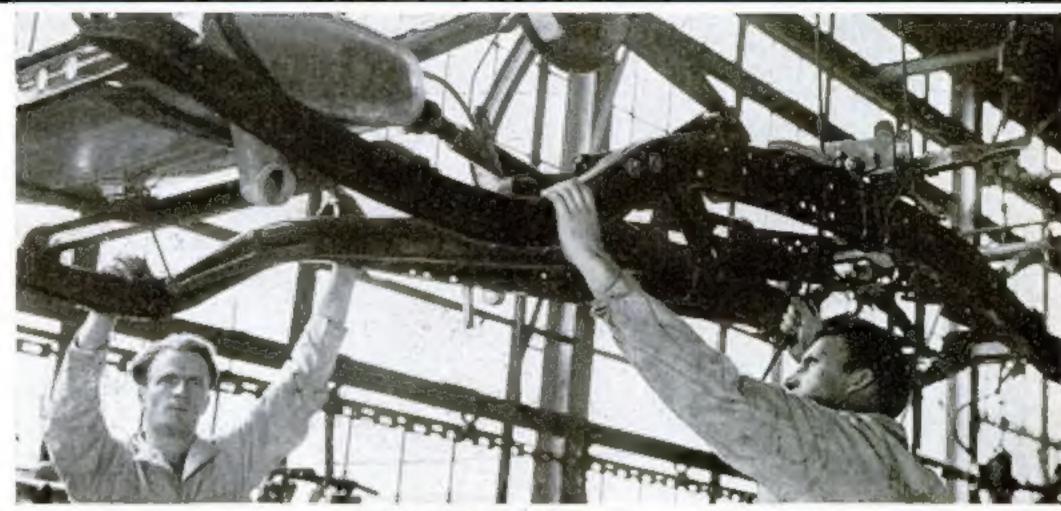
VIBRATION BANISHED HOW ENGINEERS HAVE DONE IT IN MODERN CARS

Engine Vibration and Road Vibration—both now Shut Away from You

Do you know how to pick the smoothest riding car?...

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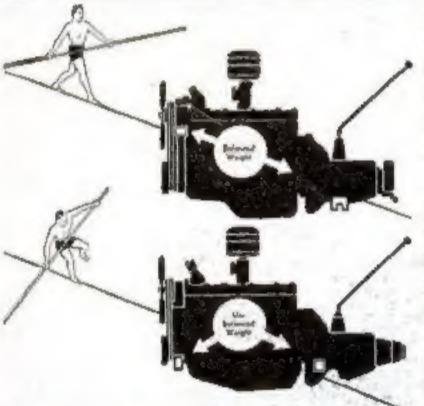
ONE BIG REASON for Plymouth's smooth, trouble-free ride. Engineers started by fortifying the frame...establishing a firm foundation against rumble, drumming and vibration.



TAPERED LEAF ENDS
MORE FLEXIBLE—
NO SOUEAKS

NO 2 MAIN LEAF
SPLIT FOR EASIER
FLEXING

TEN THIN LEAVES
—TAPERED ENDS



Big airplane-type shock-absorbers absorbers absorbers absorbers absorbers absorbers absorb bumps, jolts, rumble and vibration...you ride comfortably.

representation of the big engine of the big engine in perfect balance and eliminate vibration. (Lower left) Engine, without Floating Power, is unbalanced.

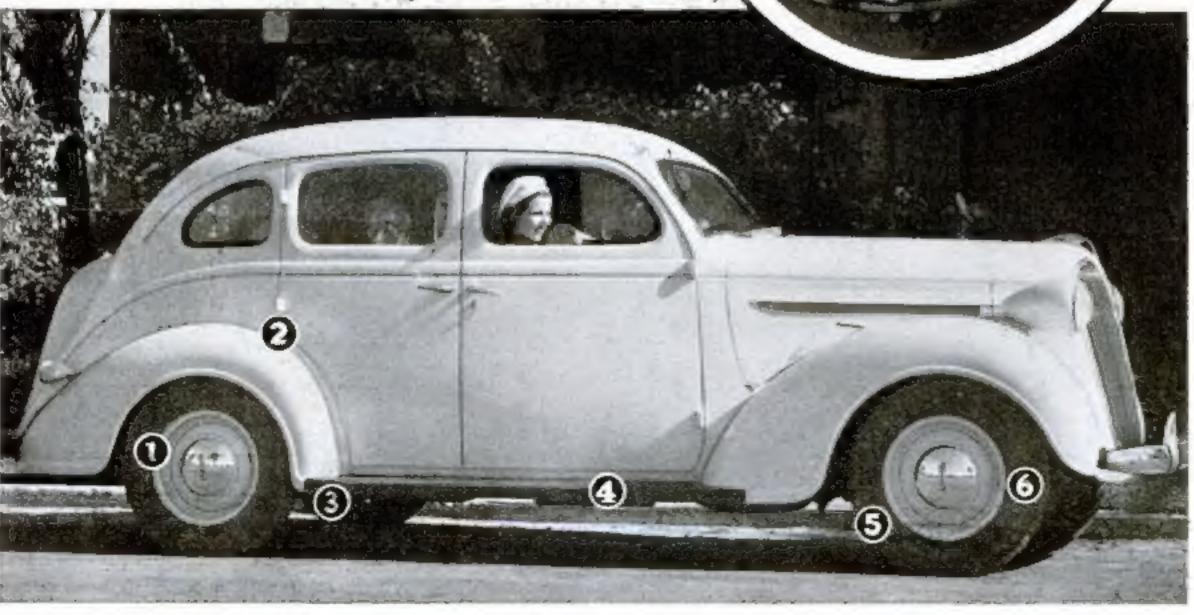
specially designed springs . . . Amola Steel which combines great tensile strength with great flexibility. Much easier riding!

plymouth's big, all-steel body is insulated from the frame by a sensationally new method...mountings of live rubber (left). Road vibration and rumble are now blocked out or absorbed... cannot reach the passenger.

- Absorbers at each wheel.
- 2 All-Steel Body...completely insulated.
- 3 Amola Steel Springs... more flexible, stand up better.
- 4 LiveRubber Cushions between body and frame.
- 5 Airwheel Tires absorb all minor road shocks.
- 6 Double-action Hydraulie Brakes... quieter as well as safer.

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Number 3

POPULAR SCIENCE

RAYMOND J. BROWN

Race for the Shyways

ARTHUR WAKELING, Home Workshop Editor
ALDEN P. ARMAGNAC, Associate Editor

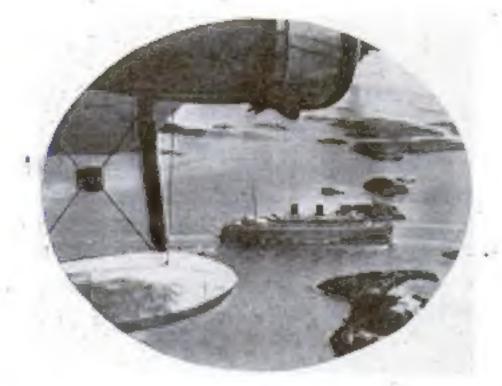
GEORGE H. WALTZ, Jr., Associate Editor SYDNEY OXBERRY, Art Editor

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The ocean liner sights a rival in the sky. Read on page 25 of the race for the air lanes of tomorrow

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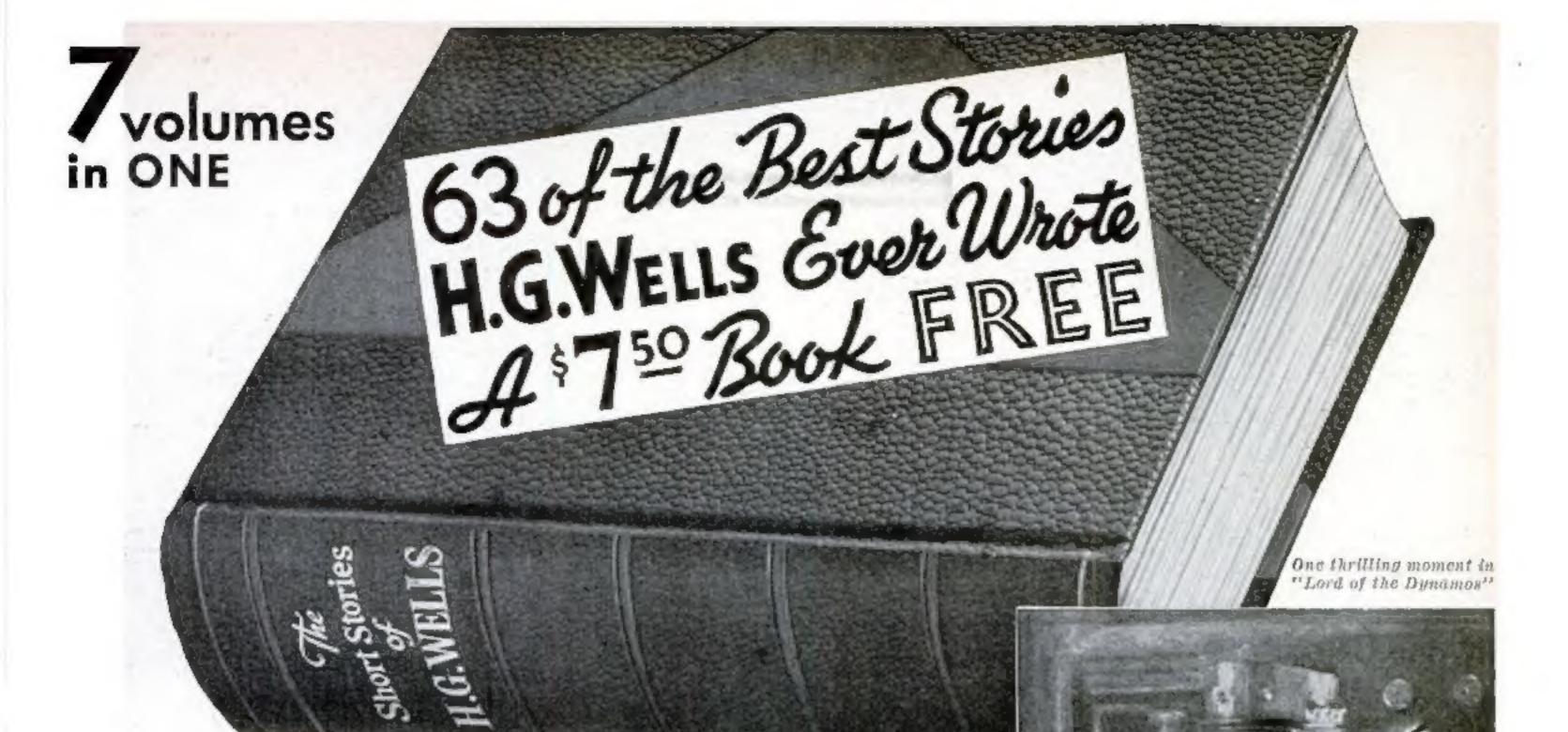
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COVER DESIGN BY EDGAR F. WITMACK

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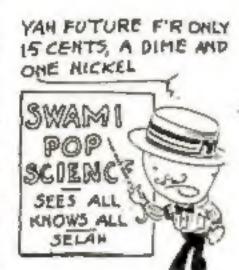
THE ELECTRIC AUTO-LITE COMPANY . MERCHANDISING DIVISION . TOLEDO, OHIO

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We Bring the News Before It Happens, He Says

THE thing about POPULAR SCIENCE that appeals to me most of all is the timeliness of so many of its articles. In the

May issue your story of "New Cities in YAH FUTURE F'R ONLY the Arctic" told how Soviet airmen proposed to land at the north pole in the near future. A few weeks after receiving this copy of the magazine, I was pleased to read in the newspaper that your prediction had



come true. Another example, which, of course was largely coincidence, is this: I was sitting home in my favorite armchair, reading your June article, "Engineers Turn Detectives to Solve Mysterious Accidents," when the news flash came over the radio telling of the Hindenburg disaster. You may be sure that I went back to your fine article with renewed interest. If more people could read it they would appreciate the difficulties that beset the investigators who are trying to determine the cause of this disaster.—O.R., Ithaca, N.Y.

Healing Broken Bone of a Knife Handle

A. L. S. asked about fixing the broken bone of his knife handle in your July issue. Well, I fixed mine with some solder. I filled the broken part with the molten metal, allowing it to lap over the bone a little, and then worked it down smoothly with a file. This repair is not only strong and durable, but neat-looking as well. I am sure that A.L.S. will find it effective.-W.K.H., Maywood, Calif.

Why Not Let Citizens Inspect National Defenses?

Count me in as a stanch supporter of R. K., Spokane, Wash. It seems to me a shame that a citizen of the United States, sincerely interested in national defense,

is not allowed to go down in the hull of a battleship or to look over a new light field gun, whereas the "brass hats" and other military dignitaries of potentially hostile nations are allowed to look them over, watch their performance under



field conditions, and in some cases, are given performance data! You have published numerous articles on shotguns, bows and arrows, but I have never seen one on remodeling rifles, especially military rifles such as the Modified Lee-Enfield, Springfield, Krag, Mauser, and Russian 7.62 millimeter rifles, which, when rebuilt make fine sporting rifles. -G.M., Burlington, Vt.

Warp-Proof Chassis Needed In Building Midget Car

I'M IN accord with W. H., of Goshen, Ind., when he asks for plans of a midget automobile, but I disagree with the specifications for the proposed buggy. Instead of a washing-machine motor, I would like to see the racer designed for a small motor-cycle engine, which can be obtained cheaply secondhand, and is a lot more powerful than a "one-lung" motor. The car should have a steel frame, bolted or riveted together. I have already made one baby auto, but I made the mistake of having a wooden frame, and the first time the car was out in the rain, the chassis warped so far out of line that the chain drive was useless.— R.S., North Canton, Ohio.

Amateur Plant Wizard Wants More on Horticulture

A most hearty welcome to your article on the cross-pollination of flowers in the

July issue! Have been reading your magazine for many years, but will now look forward to it with greater anticipation in the hope that you will publish an article, or articles, on the propagation of plants by cuttings, slips, root stocks, and grafts. How about it?-



A.R., Springfield Gardens, N.Y.

Wants To Enlarge Pictures With Auto Headlamp

MY INTEREST lies chiefly in miniature photography and in eight-millimeter home movies. A project that I would like to see described in a future issue is a miniature photographic enlarger designed to use a six-volt automobile headlight lamp for the source of illumination. I am sure that there are many other miniature-camera fans who, like myself, are not in a position to use 110-volt current and would appreciate such an article.-V.L.G., Ravinia, S. Dak.

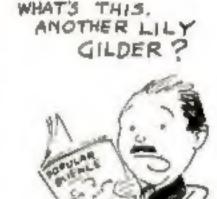
Car's Horsepower in Front Not Rear, He Says

Contending that is is wrong to say that a car "pulls out" of a hole, because the drive is taken up through the rear wheels, R. S. J., of Dexter, Iowa, forgets to consider that the engine of an automobile is in front, and that it cannot possibly push the car from that position except in reverse gear. Take, for example an ordinary horse-drawn wagon. Obviously, the horse is pulling the cart because he is harnessed to the front axle. Suppose, however, the traces should be extended so they are fastened to the rear

axle of the wagon, the horse remaining in the conventional position. According to R. S. J., the animal would now be pushing the cart because power is applied at the rear axle. I claim that the horse still is pulling, because of his position in front of the wagon. Similarly, an automobile engine pulls the car whether it is geared to the front or rear wheels. -G.S.U., Richmond, Va.

Enameling and Mineralogy Are His "Two Cents' Worth"

Perhaps it is about time that I put in my two cents worth. I would like to see something about enameling; particularly methods and technique. Also some information about mineralogy that would help a reader start a collection of the stones



and minerals in his own home town. In this, I agree with G. L. B. of Texas .-J.D.C., Carnegie, Pa.

Says Our New Type Face Makes Reading Easier

WHEN I opened my copy of the August issue, I was pleasantly surprised at the changes you have made in the appearance of your magazine. I have always considered it one of the most attractive and readable on the news stands, but the present improvements go far beyond anything I had ever thought possible from the standpoints of clarity and appearance. The new type you are using in the text of the articles is so much easier to read that it makes the articles themselves, always fascinating, even more interesting, and the modernistic headlines seem to emphasize the up-to-theminute character of each item in the book.-G.N.J., Washington, D.C.

Another Musical Oddity, The Sea-Shell Bugle

PROFESSOR WEIDEMAN, of Ohio State University, whose queer musical instruments were described in your August is-

sue, has nothing on a chap I know. This man has a large sea shell with a small hole cut in the pointed end. By putting this opening to his lips, he can play the shell just like a bugle, producing the same four notes. When he plays "reveille" or "taps," the



UGH, INDIAN BLOW-UM CONCH SHELL

effect is not exactly soothing, but the sound certainly penetrates for miles! If the Army would equip its buglers with

such instruments, there would be little need for the giant amplifiers and loudspeakers to replace human buglers as described on another page of your same issue.—J.P.J., Lynn, Mass.

A Reader's Reflections On Reflected Light

B. T. L. corrected H. F. G., saying that one does not see the stars themselves but only the light reflected by them. Prob-

ably B. T. L. does not know that we never see an object itself, but are able to detect its presence solely by the light it reflects. The colors of the spectrum are reflected light, while objects that appear black reflect little or no light and we detect



these only by the light given off or reflected by the surrounding objects. Since the distance affects only the brightness of the light, the only controlling factor is its intensity.—R.D.J., Parkers Landing, Pa.

He Wouldn't Want a Dog That Couldn't Bark

A MAN went to a veterinarian, I learned recently, to have his dog's bark removed. The "vet" refused, and also notified the local humane society of the plan. The society forbade the cruel operation. True, the nightly barking of a dog is almost unbearable to every one within earshot, but the fault is with the dog's master. The owner should be forced to keep his dog quiet at night. It can be done by proper training and not by a cruel throat operation. I would not like to own a dog that couldn't bark, and I don't think A. L. B., of Newark, N.J., would want to have a voiceless pet, either.-E.L.S., Houston, Tex.

Pipe Inspector's Mental Hazards Are Too Great for Him

Among the jobs that I don't envy is that of the man who rides through the Los Angeles water pipes, as described in your July issue. Yes, I know all kinds of

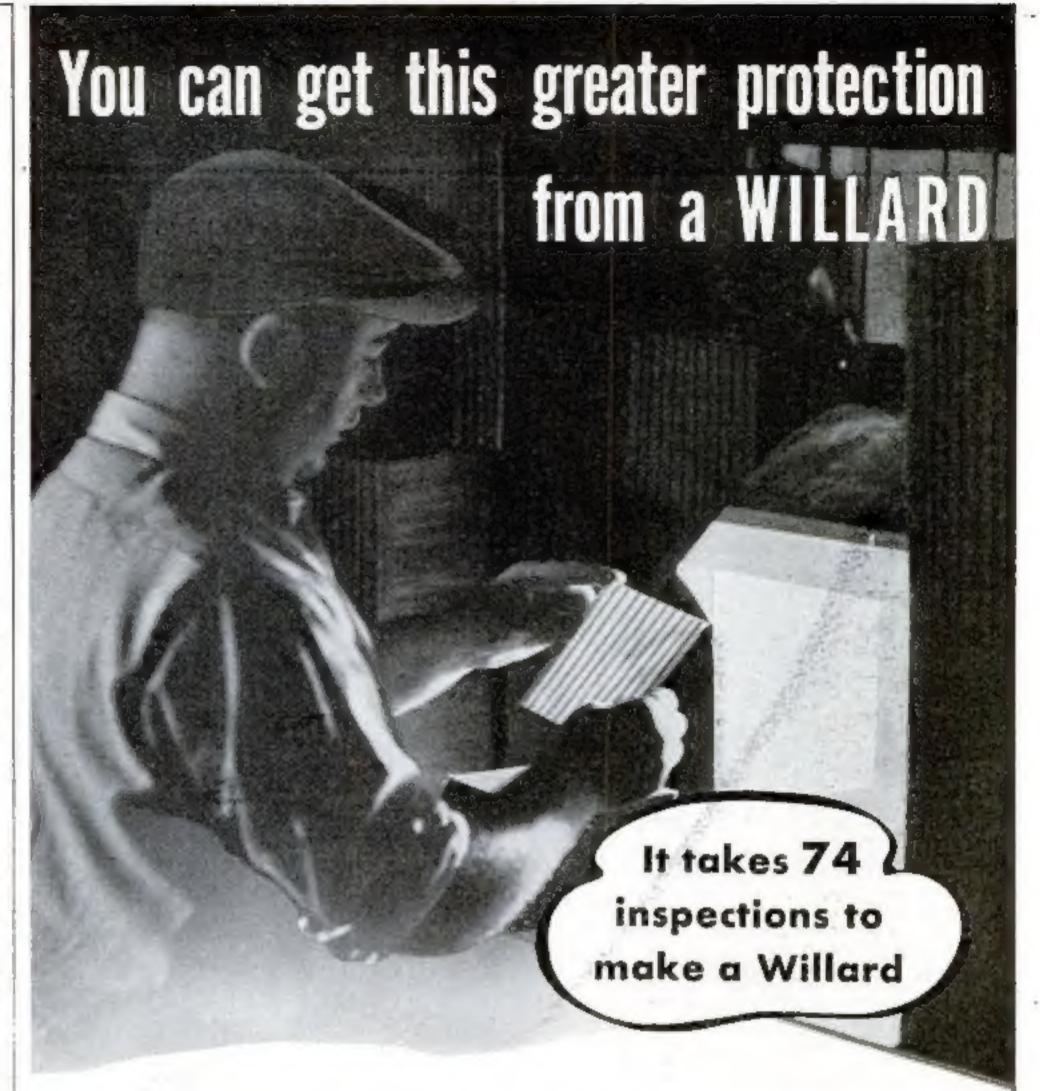
precautions probably are taken to insure the man's safety, but the operator of the little tube-inspection car must be devoid of imagination if he doesn't start thinking of unpleasant possibilities when he knows he is half a mile away from the near-



est opening in the pipe. Suppose, just suppose, that someone should turn on the water by mistake. No, thanks! I'd rather have a good safe job as a structural-steel worker.—R.A.J., Jersey City, N.J.

Air Current, Not Heat, Is Fly's Danger Signal

Science is too exacting to be contaminated with guesses like those of R. W. H. of Melbourne, Australia, in his letter on swatting the fly. A fly escapes a cold object as well as a warm one, so it is not temperature that warns him. How about air pressure and currents? The fly feels the pressure in- (Continued on page 8)



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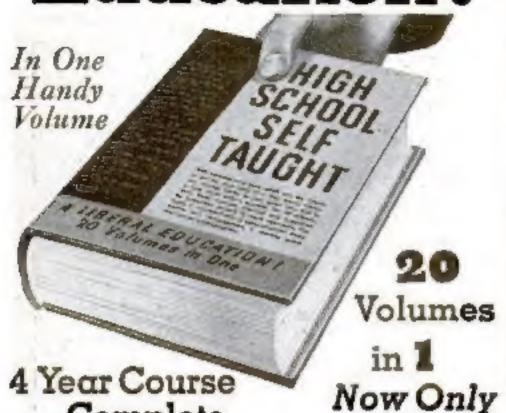
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Our Readers Say

(Continued from page 7)

crease as the swatter approaches. This air pressure sets up lateral currents that actually aid the insect to escape from under the approaching hand or swatter. At the first sign of increased air pressure, the fly immediately spreads its wings and with very little effort is carried away in the sweep of air currents, and escapes. That's why a screen-type fly swatter is so effective. The air sifts through the perforations and the air pressure is not increased enough to warn the victim in time for him to escape. You can even get the fly with a screen swatter that has been on a hot stove. making it much warmer than the hand would be. Let's be more scientific.-E.A.P., Clinton, Iowa.

Reader Wants Plans For Powered Houseboat

As a regular reader of Popular Science Monthly, I would like to see you publish complete plans for a powered house-

boat, possibly of the scow type with inboard motor, about twenty to twentyfive feet in length. I believe that there are many other readers who would be interested in the same idea. This type of boat is very inexpensive to build and gives an unu-



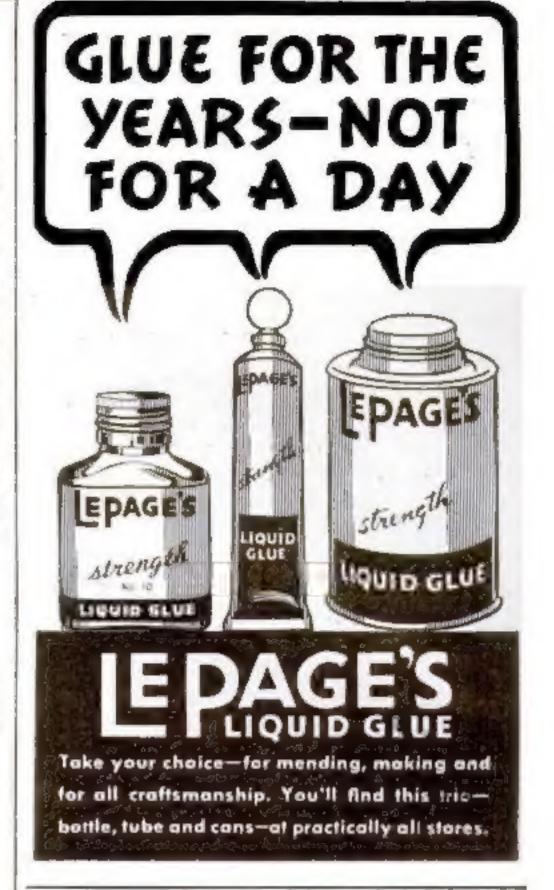
sual amount of cabin space. For streams with comparatively little current, it is ideal.—O.M., National City, Ill.

No Short Cuts, We Suspect, In The Path Problem

KEEP up the mathematical problems, they are very interesting. The solution to the problem by H. J. D. of Putnam, Conn., seemed quite simple, but long, to me. I would like to hear from H. J. D. whether or not my solution—that 417.58 square feet of paving material are needed—is correct, and if so, is there a short method of calculating this?—E.J.M., Milwaukee, Wis.

Secret of Female Efficiency Would be Useful to Men

"Women apply their energy more efficiently than men," says one of your recent articles. I was greatly interested in seeing scientific evidence along this line because I recently had the fact impressed on me rather strongly. Last December, my wife went away to spend the holidays with her folks, leaving me to keep house alone. Inevitably, things got in a pretty bad state, because I didn't have much ambition, after coming home from business, to put things in order. So, I resolved to spend the Saturday before her homecoming doing a thorough job of house cleaning. Perhaps I tried to do things too thoroughly, but anyway, by the time supper time came 'round, I found myself pretty well tuckered out, and with only three rooms cleaned, so I gave up. An hour after my wife came back, the next day, the household began looking almost livable again, and by the time I had returned from work Monday evening, everything was in applepie order. I wish your article had given us men the se- (Continued on page 9)





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cret of women's greater efficiency, because as things are, I can only gaze at my wife's frail-looking physique and shake my head at the question, "How in the world does she do it?"-H.P.D., Ashtabula, Ohio.

New England's Cloudy Weather Spoils Astronomer's Fun

RECENTLY I went to the trouble of building a telescope to study the stars, but when it was complete, I was sadiy

disappointed because I had failed SHAKE, BUDDY, I BUILT to take into account the local weather conditions. Living here in New England, where perfectly clear skies are rare, I guess I will have to reconcile myself to being a "cloud-onomer" instead of an astron-



omer. I would like to see letters describing other readers' experiences in amateur astronomy.-H.L., Medford, Mass.

There's No Need for Hedging On this Fence Problem

A PROBLEM whose solution comes out even seems to be a rarity; here's one that does. I hope it will prove as interesting to other readers as some of the previously published problems have been to me. I built a fence around a ranch that is perfectly square, using boards eleven feet long, and making the fence three horizontal boards high. As it turned out, there were exactly as many boards in the fence as there were acres in the ranch. How many acres were in the ranch?-J.M., Aberdeen, Wash.

Wants All There Is To Know About Modern Electricity

Your articles on chemistry and electricity have proved valuable to me. I think that those on chemistry by Raymond Wailes are fine, but not wide

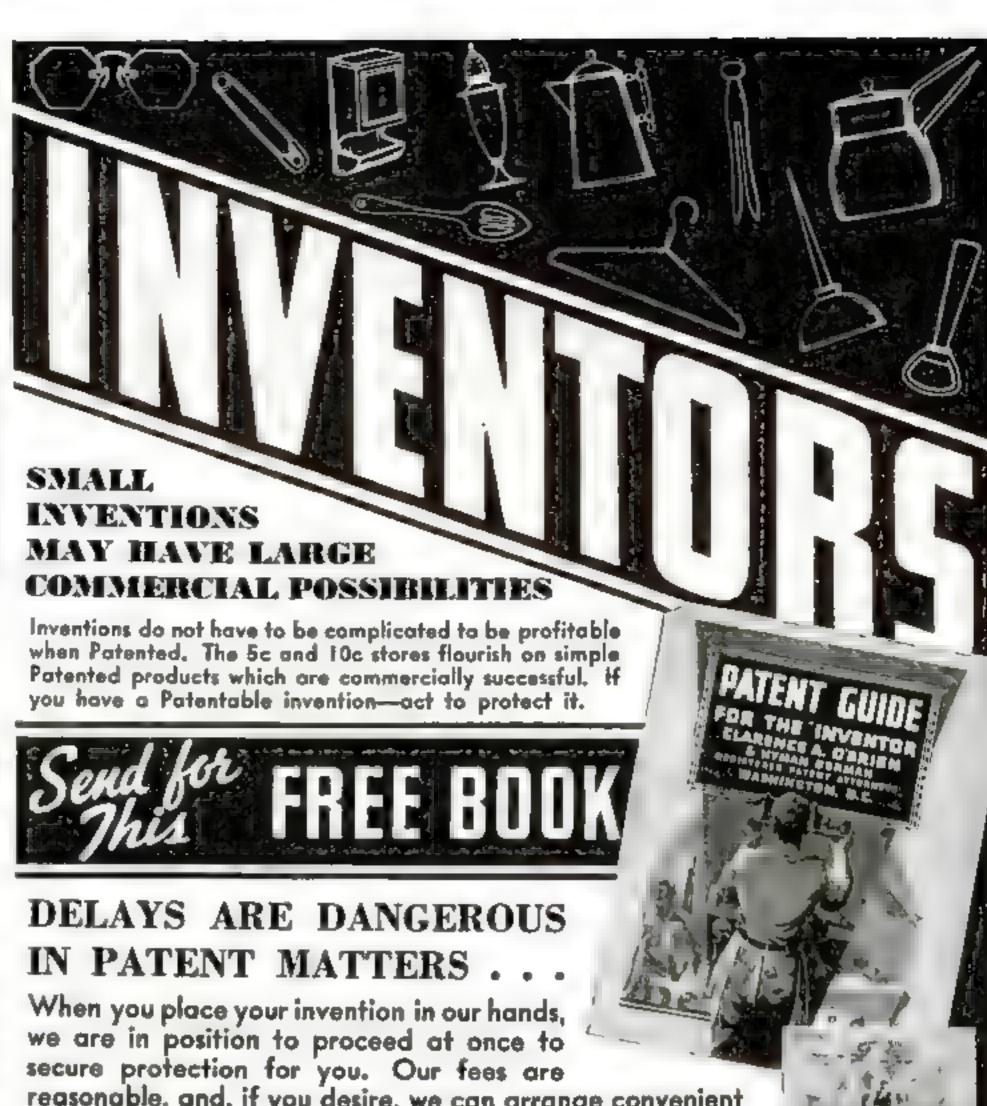
enough in scope. I have built some of the electrical devices described by Kendall Ford and have had wonderful results. In the future I would welcome articles describing the construction of, and experiments with, photo-electric cells,



relays, arc lights, Tesla coils, transformers, electroscopes, the electrophorus, electromagnets, galvanometers, and static machines.—D.H., Columbus, Ohio.

American Cars Should Win On Our Own Race Tracks

HAVING just finished reading newspaper accounts of the Vanderbilt Cup Race, I want to know why it is necessary for Americans to be beaten on their own race track by foreign cars. Our manufacturers have long excelled in making stock passenger autos, and with their vast research facilities it should be easy for them to build winning racing cars. If each of the large motor companies were to maintain a fleet of racing autos, it would be the source of good publicity, and the experience gained would be of great value in building better stock cars.—P.A.F., Hartford, Conn.



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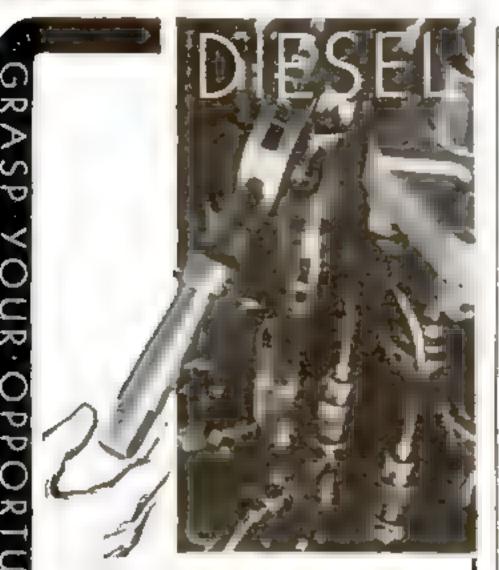
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CONTEST RULES

Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

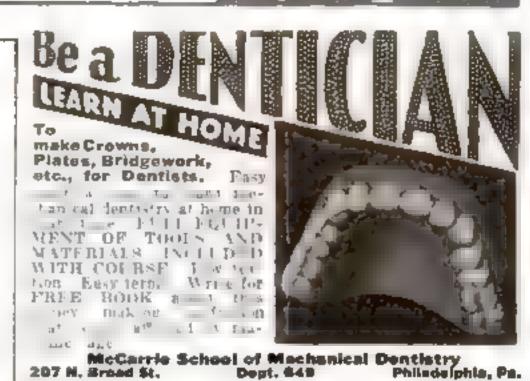
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"MORE ADVANTAGEOUS THAN CLASSROOM STUDY"

WHEN I started out to become selfsupporting, I had had no training whatsoever in any line of work. Consequently, I had to take whatever was offered at first and considered myself lucky to secure a position in general office work.

While grateful for the opportunity to earn a regular salary, I was not entirely satisfied, for some inner craving to do creative work kept urging me on to try for something better than bookkeeping.

Some how, some way, there was born in my consciousness a desire to write. My first attempt was to tell the story of a dream. Then the idea came to do it in scenario form but here I hit a snag because I hadn't the faintest notion of construction for screen presentation.



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Secrets of Success

ing with high hopes and visions of immediate success.

I wish I could say that I achieved my ambition and became a successful screen writer as the result of this training, but I must be honest and report that I never sold a single scenario. The course, however, was invaluable to me in other ways. It taught me to get the most out of what I was studying, to rely upon myself and to work out original ideas which lay dormant until I learned to express them.

I discovered the fundamentals of drama, found out how to cultivate a "seeing eye" and develop an understanding of literary values. Moreover, the study gave me confidence and enabled me to secure a position with the ----- Advertising Company.

After fourteen months with this agency, my employer recommended me for a position with another company where I would have more experience in creative writing. While here, I wrote publicity for the local papers, prepared advertising copy, and wrote hundreds of special features. Specimens of my work were highly complimented by men high up in the advertising business and I honestly admit that I am quite proud of my record.

In some ways I think a correspondence course is of more advantage than class room study and if the training is taken with the determination to learn everything in the course, a door will certainly open to larger opportunities.

-A.Z., Center Lovell, Me.

"JUST ONE COURSE AFTER ANOTHER"

MY LIFE has been just one home study course after another for I believe that no minute should be wasted.

In 1903, I went to work for the Oil Company as office boy and rose through various departments to shipping clerk. Then, in 1911, a friend told me that the — Bank needed a bookkeeper, so I went to see the president and secured the position which paid \$100 a month-\$25 more than I had been making.

I knew absolutely nothing about bookkeeping and told the president so, but I also told him that I knew I could hold the job if he would give me a little time to get adjusted. Accordingly I enrolled immediately with the School for a course in business administration, got a slight smattering of what it was all about, and started work. The other bookkeepers in the bank helped me and I kept on with the course.

When this was finished, my uncle and I purchased a higher accounting course from the same school which we studied together for several years.

During this time I advanced through all the various departments of the bank-bookkeeper, collection clerk, teller-and then I had an offer from a fertilizer concern which needed an allaround accountant who could figure costs and run the general books. I took

Are You STILL in the DEPRESSION??

TIMES are better.
Business is out of the rut-well ahead of a year ago. Millions of men have gone back to work. There's more money in lots of pay envelopes. But what good is that to you, if your pay check is still written in depression figures?

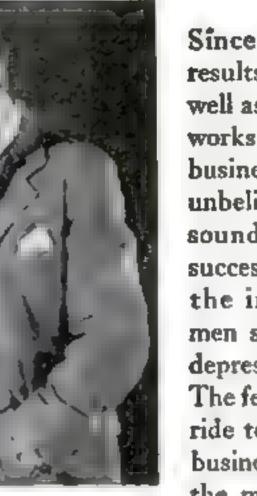
You weren't so discontented a year ago. In fact, you considered yourself lucky to have a

job. But now-you have begun to wonder and worry why the oncoming tide of prosperity hasn't reached you yet. The situation is getting desperate. Bills continue to pile up. You can't get along forever on a "shoe string" budget. You must win back those pay cuts. Other men are doing it-how can you?

Certainly, you can't work any harder than you have been. And it isn't a question of your intelligence, honesty or ambition. Those virtues do not solve today's problem-they are often insufficient to hold down a job, as millions unemployed sadly testify.

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There's real danger to accepting "depression pay" these days. A danger that lower wages will continue to dog youfor no employer will pay more until he is convinced you are worth more. Some day, some way, you've got to convince him. There's no time to lose. The sooner you begin, the better.

If the LaSalle Plan has fulfilled this aim for thousands, isn't it logical to expect it can do as much for you? This coupon can easily become your passport to better times. Mail it today.

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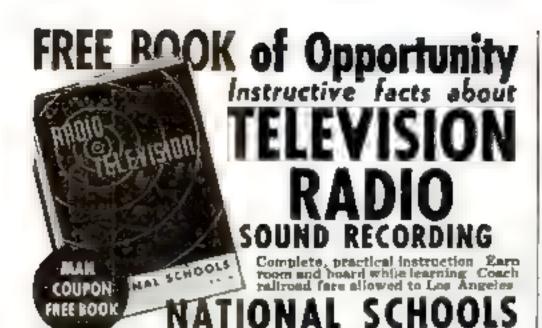
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Secrets of Success

this position and held it for several years at a good salary, eventually being advanced to office manager.

Then I took the --- course in C.P.A. coaching and left the fertilizer company to go into business for myself. For several years I made a good living doing accounting for a number of business concerns until one day one of them made me an offer of a fulltime job and I took it. I am still with this company and do some accounting as a side line in my spare time.

Frankly I don't see how any person can get along without home study. I have taken several other courses besides those mentioned, just to pass away the time in the evening, among them one in cartooning and find that I am very proficient at it. I am 46 and for most of my adult life I have studied, studied, studied for business, for health and for pleasure. No one can down me physically, mentally or in my line of business. And I say again, all is due to home study.

H M.M., Savannah, Ga.

STAGE HAND BECOMES ENGINEER

As a stage hand I was making good money in show business. Then came talking pictures, displacing more and more the road shows upon which I depended so I was obliged to look for another trade.

I signed up as an oiler in a Dieseldriven pumping station of the ----Refining Company but not having had any knowledge of Diesel engines I knew I would have to study in order to make good. Within a month I started a Diesel engine course with the ---School and, as I was paying out hardearned money for it, you can bet I studied hard to get the most out of it.

It was May 1931 when I started this job as oiler and in November of the same year I was advanced to relief engineer with a small increase in pay. The company knew I was trying to make good, because the school mailed them a report on my lessons, so they did all they could to encourage me.

In July 1932 I was advanced to fulltime engineer with more than double the pay as oiler. I like my job and I hope to go further in this branch of engineering. Every year more and more Diesel engines are being installed and I would advise anyone who is not afraid of hard work to take up the study of them in his spare time .-W.B.S., Cincinnati, Ohto.

Propose Use of Yellow Danger Signals

To REPLACE red warning signals, which often are confused with the common neon signs, it is proposed to use the new sodium-vapor lamps. Because they produce a peculiar yellow light, unlike anything in common use, the new lamps are said to be effective warning signals.

Tests Show "Bad Roads" Slow Down Radio Waves

RADIO waves that hit "bad roads" and take "detours" have been observed by scientists at West Virginia University. While radio waves theoretically travel at the speed of light, the experimenters discovered that their speed may be slowed down to as much as fifty to eighty-five percent less than the maximum. From a West Virginia radio transmitter, signals were sent out to a South Carolina station, and automatically retransmitted back to their source. After the lag in the retransmission of the signals had been accurately measured and discounted, the time taken by the waves was found to be double that needed to cover the 400-mile span. The "detour" and delay was caused, the experimenters stated, by the roundabout path the waves traveled from the transmitting antenna up to the high-altitude ionosphere layers from which they bounced back to earth. Changes in the reflecting layers between separate radio tests explained the variations in the time taken by radio waves to travel identical distances.

Camera Snaps Flares To Gauge Night Wind

CAMERAS equipped with wide-angle, 180-degree lenses are being used to photograph the flashes of magnesium flares attached to sounding balloons in order to chart the direction and velocity of night winds high above the earth. Due to its special lens, the new-type camera when set up on the ground and pointed skyward takes in the entire sky from horizon to horizon. As the sounding balloon soars aloft, brilliant magnesium flares flash at regular intervals and are recorded on the film to form a permanent chart of the drift and speed of lofty air currents. The new camera is expected to be of value in weather forecasting and air-line operation. The photographic wind charts are useful in comparing air velocities at different times of the night.

Rubber Coated Seeds Resist Parasites

Rubber-Coated seeds are a new contribution to agriculture developed by an English experimenter. Before they are planted, the seeds are covered with a layer of liquid rubber in which is mixed fertilizer, fungicides to kill parasites, and bacteria of a type that reduce nitrogen from the air into a form which the seeds can use. The thin rubber shell is porous to allow the penetration of water. Plants grown from the rubber-coated seeds are said to be exceptionally healthy and to produce a greater yield than those raised from untreated seeds.



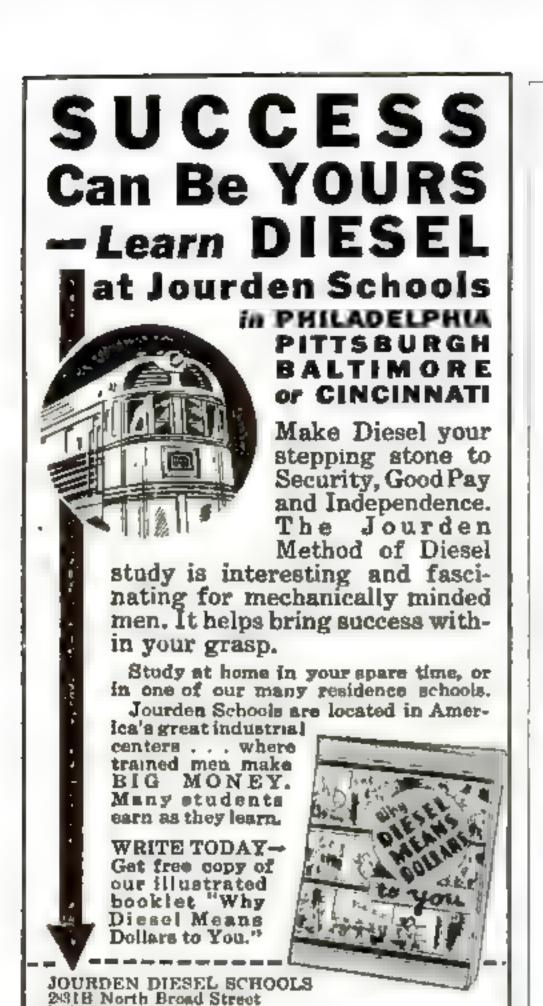
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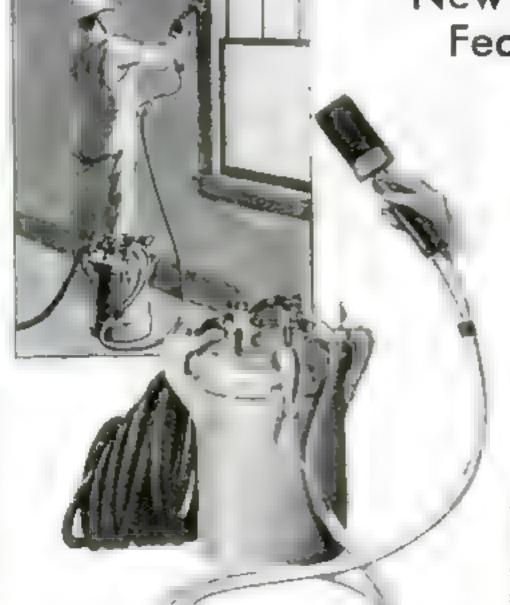
Handy Aids for Home Mechanics



In place, the new window opener fits flush with the jamb, only the crank projecting

Novel Window Opener Is Self-Locking

CASEMENT windows now available in complete prefit units are opened and closed with a new type of crank-operated, self-locking adjustor. Built into the jamb, the control consists of a link chain which engages a spiral worm gear. Turning the conveniently located crank, rotates the worm gear which moves the chain, while an automatic brake locks the window in any position. The adjustor is said to be entirely silent and smooth in operation.



New Automatic Paint Brush Fed By Compressed Air

OPERATED by compressed air, a new automatic paint brush is said to combine the speed of spray painting with the dependability of hand brush work. As shown at left, the unit consists of a changeable brush head, connecting rubber tubes, and a pressure chamber. In use, the pneumatic brush is manipulated with an ordinary brushing motion, slight pressure on a button in the handle serving to open a valve that allows the paint to be forced out onto the bristles.

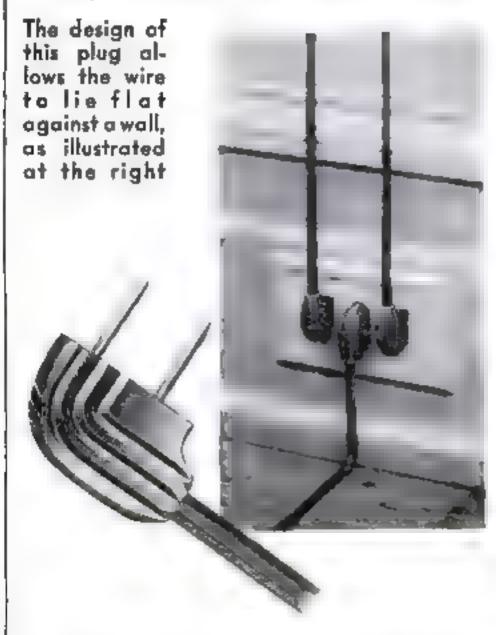
A button on the handle controls flow of paint in the air brush shown at the left



Housing a tiny electric lamp that costs but five cents a year to operate, an ingenious door-bell push button serves to illuminate the name plate mounted above it. The new button is easily connected; its two wires merely being substituted for those of the existing unit.



Neat Connection Given by Right-Angle Plug



Inserted in an outlet, an electric plug of right-angle design lies flat against the wall, with its connecting cord hugging the baseboard or wall surface. Made of rubber, the angular plug assures neat and inconspicuous connections to floor and table lamps.

Questions FROM HOME OWNERS

Q.—What is a good material to use in repairing a crack that has developed in the iron casing of our kitchen stove?
—W.S.K., Baltimore, Md.

A.—MAKE a thick paste by mixing iron filings and common water glass. Force the mix into the crack with an old knife or trowel, and then coat the surface of the crack with a layer of the same material. Heat from the stove will bake the filler material and make it very hard. If applied carefully, the cement is very durable.

Laying Short Shingles

G. U., LOUISVILLE, KY. Shingles are generally sold in twenty-four, eighteen, or sixteen-inch lengths. In laying the latter, place them so that no more than five inches of wood is exposed to the weather. They should be spaced about an eighth of an inch apart and staggered so that joints do not occur directly above one another. Then you will be sure the roof is weatherproof.

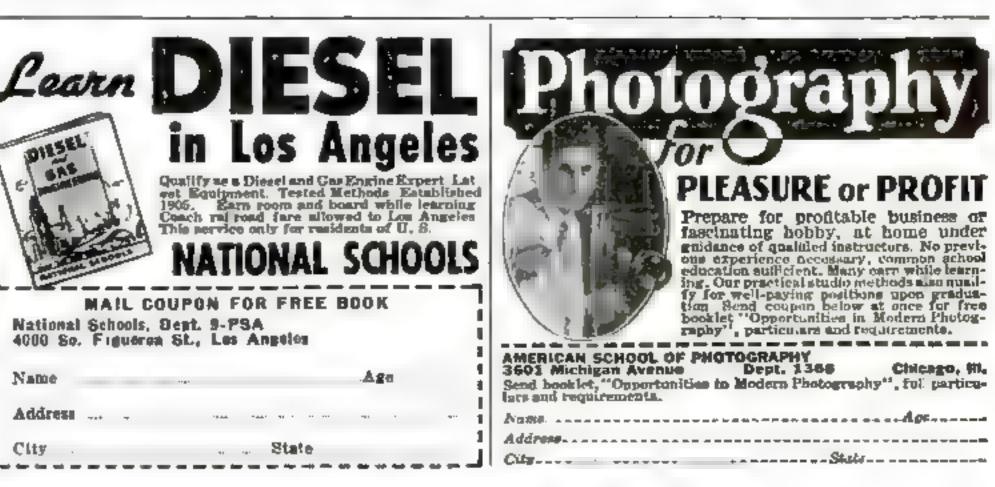
White Stain on New Brick Wall

T. Q., MADISON, WIS. The whitish efforescence that sometimes appears as an unsightly deposit on the exterior of a newly laid brick wall is caused by mineral salts brought into solution by the water in the wall and deposited on the surface as (Continued on page 16)



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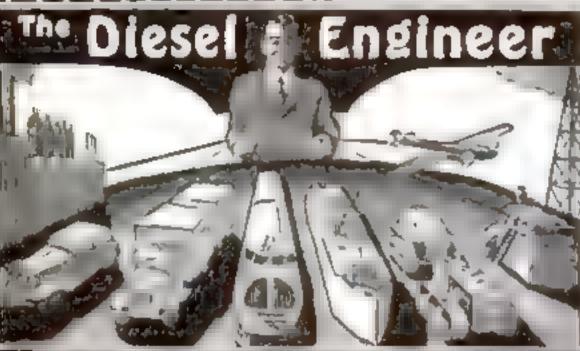
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Questions from Home Owners

(Continued from page 15)

the water evaporates. The deposit usually disappears with time but can be removed by scrubbing it with a wire brush dipped in a solution of one part muriatic acid and six or eight parts of water. After brushing, wash the surface thoroughly with water and then with a diluted ammonia solution in order to remove every trace of the acid.

Finish for Chemistry Bench

Q.—HAVING taken up chemistry as a hobby, and constructed a wooden bench for conducting experiments, I would like to know of a good way to protect the surface against acids and other chemical solutions that may be spilled on it.-G.D., Salt Lake City, Utah.

A .- APPLICATION of the following solution will form a protective coating and also lend a good black color to natural, unpainted wood: four and a half ounces of copper sulphate, the same quantity of potassium chlorate, and thirty-six ounces of water. Apply with an old paint brush.

Working With Plaster of Paris

B. K., PITTSBURGH, PA. When using plaster of Paris to patch up holes in a wall, do not mix up any more than you can apply within ten minutes, since the material sets very rapidly. However, you can mix up a larger quantity by using a retarding agent such as a small amount of common glue dissolved in the mixing water. Various other retardants can be used, among them being ordinary household vinegar.

Fog on Furniture Finish

F. H., JEFFERSON CITY, Mo. to remove the foggy appearance that often mars the beauty of a highly polished piece of furniture, rub the surface with a soft cloth that has been dipped in a weak solution of water and vinegar. Use no more than a tablespoonful of vinegar to a quart of water, and always rub with the grain.

Spread Cellar Whitewash Thin

R. C. M., WATERBURY, CONN. A thin coat of whitewash on a cellar wall will generally give better results than a thick one. Apply the mixture so that you can see the wall surface through the wet whitewash film. It will dry out to an opaque finish. This thin coat of whitewash is less likely to chip off than a thick, heavy coat of the material.

Marking Leaks in Roof

J. S., DENVER, COLO. In examining your roof from the attic to locate leaks, push broomstick straws or pieces of wire through the holes to enable you to identify the spots when you get up on the roof to make repairs.

Special Camera Snaps Corona in Eclipse

EQUIPPED with a whirling disk that governs the exposure in different parts of the picture, a special camera has been designed to photograph solar eclipses. The corona, seen around the sun only when the moon covers the solar disk, ordinarily is difficult to photograph because it is impossible to record its faint, outer edges without overexposing the brilliant portion nearest the sun. The new device, employed for the first time in the eclipse of June, 1937, makes use of a pierced disk rotating in front of the camera lens at 100 revolutions a minute. Four openings in the disk are arranged so that at the outer edge, where full exposure is needed, almost all the light from the corona is permitted to pass into the camera. Near the center of the disk, the openings are constricted to prevent overexposure of this part of the picture.

Microbes Clean Fibers for New Textile

A NEW textile industry based on an ancient fibrous plant material is forecast with the discovery of a microbe that will clean the fibers of the ramie plant in the same way that linen fibers are "retted" by soaking. Ramie is a plant that has been cultivated for centuries in Asia; it produces both the strongest and the longest vegetable fibers known, stronger than flax and longer than cotton. In addition, the ramie fiber is almost as lustrous and beautiful as silk. In the past, ramie has never had much commercial use, because it is difficult to get the fiber out of the plant stems and free it from resins and gums. A new process, discovered by Italian experimenters, makes use of a special shredding machine to loosen the fibers, after which they are exposed to the action of the newly discovered bacilli. After a period of this treatment, the fibers emerge separate and clean, and ready to be spun and woven into fabrics.

Fish to be Kept Fresh in Underground Vaults

SUBTERRANEAN vaults, tunneled into frozen soil, may serve as natural storage refrigerators for fish, according to the expectations of one of the scientific commissions now engaged in opening up Russia's vast arctic empire (P.S.M., May '37, p. 25). To keep the sea food fresh before canning, or while awaiting shipment to other parts of Russia, it would be stored in the proposed refrigeration tunnels, where it would freeze quickly and keep for an indefinite period. Only the top ten or twelve feet of arctic soil thaws out during the summer, and the icing chambers would be excavated at underground levels known to remain solidly frozen the year 'round.

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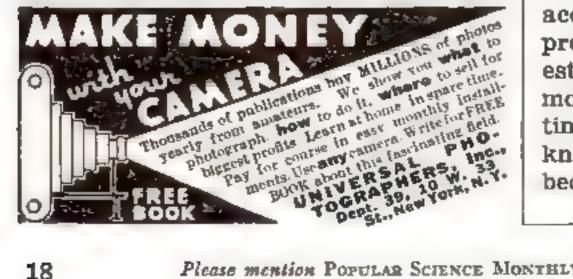
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Wheat, Sowed Once, Comes Up Annually

A NEW type of wheat that needs to be planted only once, and then comes up of itself, year after year, is the development claimed by a Russian plant breeder. The new grain is a cross between ordinary winter wheat and a Siberian variety of quack grass, a weed that is troublesome to farmers almost everywhere. The grass has spreading roots that continue to live and send up new shoots even if the weed itself is destroyed. To combine these enduring roots with the edible-seed-bearing qualities of wheat, the Soviet technician spent five years in experiments that finally produced a plant having the desired qualities. Three successive crops of the new plant have been grown, and bread has been made from it. The flour has more gluten than wheat flour, and the bread is said to have a superior flavor. Practical field trials of the new grain are expected to begin shortly. Once the roots are established, it is anticipated, a new crop of wheat will come up every spring. If these hopes are confirmed, the new wheat probably will be considered one of the most important agricultural discoveries brought to light in years.

Mangrove Bushes Change U. S. Coast Line

MANGROVE bushes growing along the Florida shore are adding new land to the coast line of the United States. According to a report based on frequent observations and careful comparisons between old maps and recent aerial photographs, the bushes, which grow in salt water and have numerous roots. have served to alter the shore line by catching and accumulating the silt and clay in the water. When they decay, the mangroves form peat which aids further in the land-building process. To test the possibility of using the bushes in this way on a large scale, experimental plantings have been made at several points along the eastern coast.

Charts of Ocean Floor Would Aid Navigators

MAPS of outstanding physical features on the ocean floor would serve as supplementary guides to navigators, according to a recent proposal. When regular navigating instruments are made useless by cloudy weather and radio bearings are distorted by static, submarine valleys, peaks, and plateaus, accurately spotted on charts, would provide "landmarks" to help a vessel establish its location by the use of modern depth-finding apparatus, which times the passage of sound waves of known speed from the ship to the ocean bed and back.

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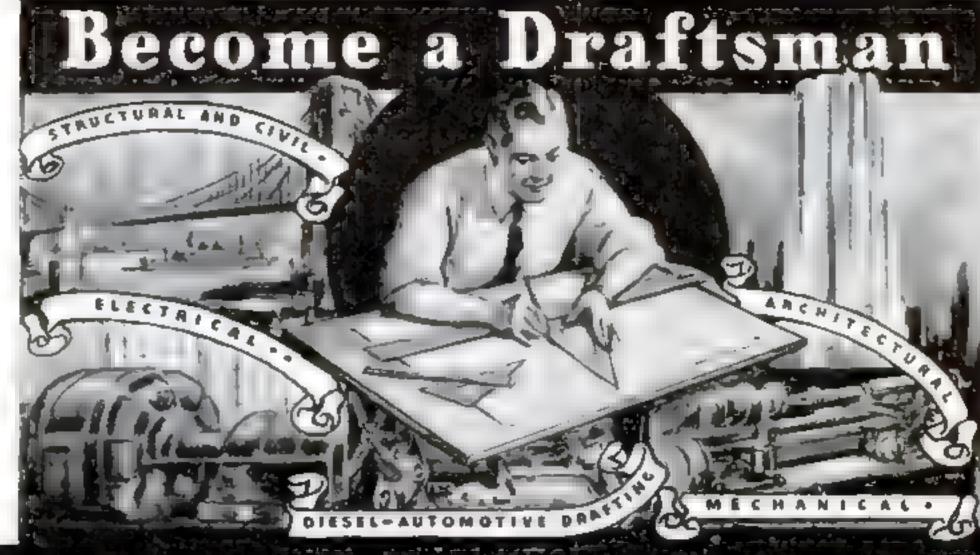
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As nearly all manufacturing—construction—building starts on the drafting table, the draftsman is one of the first to be hired and one of the last to be laid off. It is his blue-prints, his specifications, that give the last word in what the workmen are to do. No article, building or construction job is started before the plans drawn by the draftsman have been officially approved.

Good Pay

The draftsman has been called the Junior Engineer which title just about describes his work, position and pay. He combines his knowledge of principles, mechanism and construction details with the ability to draw plans and indicate motions and methods on paper. On the average, his salary is considerably above the wages of the mechanic and, of course, less than that of the engineer.



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Chance for Promotion

Developing plans, new machines or new construction methods—the draftsman works directly with important men of the organization. So he knows what is being considered and planned. It may be the superintendent—engineer—even the prospective buyer with whom he consults. These contacts, plus his experience and general knowledge of the business, place him in an excellent position for promotion when next there is a good opening.



A Job Where You Are Not Old at 40

Athletes, farmers, and factory and shop workers who rely on muscle start growing old even before they reach 40 while office workers, executives, teachers, professional men—in fact, all kinds of brain-workers—are just approaching their prime at 40 to 50. Training increases your value AT ONCE and continues to help boost your expension power as you mature and as you increase your expension and background for forming judgments of your firm's policies and methods.

Train NOW for 40 and the Years Between!

Even if you now are only 18, 25 or 30, you should look ahead—begin training TODAY for the job you want at 50. Training helps you to be independent—self-supporting. It helps you to enjoy associations that are denied the untrained man. Training helps you to increase your earning power more QUICKLY—and by so doing to offer members of your family advantages far in excess of what you could give them as an untrained man. Train and enjoy PROGRESS—CONTENTMENT—INDEPENDENCE.

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Artificial Tears Made for Killing Germs

ARTIFICIAL TEARS extracted from cabbage and horse-radish plants may provide a new and potent weapon against germs, according to the experiments of Russian scientists at the All-Union Institute of Experimental Medicine in Moscow. Human tears, it is explained, contain a chemical called lysozyme, which helps to annihilate the germs which come in contact with the surface of the eye. Hordes of professional criers could not supply a sufficient amount of tears to make extraction of lysozyme commercially practicable, but Russian

to extract a similar chemical from certain plants. The value of lysozyme, the experimenters state, is that it will not damage healthy tissues like many powerful antiseptics, but confines its death-dealing activities to harmful germs. In action, the chemical dissolves away the thin protective coating that many germs possess just as an acid eats away a coating of nickel on articles made of brass or iron. Once robbed of their outer layer, the germs are easily killed by practically any antiseptic.

Pills Are Tested as Hay-Fever Cure

HAY-FEVER sufferers may find relief by swallowing a pill instead of submitting to a long series of injections with a hypodermic needle, according to recent researches made by Prof. Erich Urbach, Austrian scientist. Under present methods, severe cases are treated with chemical preparations to "desensitize" a patient to the dust or pollen that causes his ailment. The chemicals have to be injected with a needle, beginning with a small dose and gradually increasing the amount.

Under Professor Urbach's method, the offending dust or pollen is treated with a vegetable digestive substance and made up in the form of pills. Repeated experiments have shown that if the pills are taken on an empty stomach, and followed by a glass of slightly acid water, they will be absorbed into the blood stream and have as great a desensitizing effect as though they had been administered by conventional injection methods that cause great discomfort to some people.

Experiments Disclose Facts About Shaving

PREPARATION of the face is the most important factor in insuring a smooth shave, according to results of a sixyear study of shaving methods. Experimenters recommend washing with soap and water before applying lather.



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Car Drivers "Stutter," as Well as Speakers

STUTTERING is not solely a speech defect, but may affect a person's ability to play golf, drive a car, or operate a typewriter, according to a statement by Dr. James S. Greene before a recent scientific meeting in New York City. A nervous ailment, stuttering or "chronic hesitation" has been observed in piano players who could talk fluently but who became stuck on a certain note, just as a speech stutterer does on a certain word in a sentence. Spasmodic repetition of notes by a violin player, inability to dance rhythmically, bad form in swinging a golf club, and other physical disabilities may be attributed to the spasms of stuttering. Dr. Greene said. Nervous hesitation is also seen among automobile drivers who impart their stutter spasms to their machines through the steering wheel, accelerator, and brake pedal.

Lack of Oxygen Blamed for Airplane Crashes

LACK of sufficient oxygen for transport pilots flying at high altitudes is suggested as an important contributing cause of many airplane disasters, in a recent statement by Dr. Alvan L. Barach, of Columbia University, who suggests that all commercial pilots be required to wear face masks similar to those used in hospitals for administering oxygen. To explain the assumption that nine tenths of all plane accidents are caused in some degree by a failure on the part of their pilots, Dr. Barach presented medical data to show that mental and physical efficiency may be definitely impaired by lack of oxygen at altitudes as low as 8,000 feet, while modern transport planes often cruise for extended periods at levels above 10,000 feet, where there is even less oxygen.

"Vacations" Suggested for Electric Wires

GIVING wires an occasional rest from carrying electric currents will prolong their useful life, it is stated by a French scientist, who believes that constant use is an important factor in the aging and breaking of outdoor transmission lines after years of service. In laboratory experiments completed recently, one set of copper wires carried electric currents constantly for two years, a second set were used as conductors for only two weeks at a stretch, and a third set carried no current at all. Strength and breakage tests revealed that the wires that had conducted current continuously were weaker and more easily broken than those which had been given periodic two-week "vacations."

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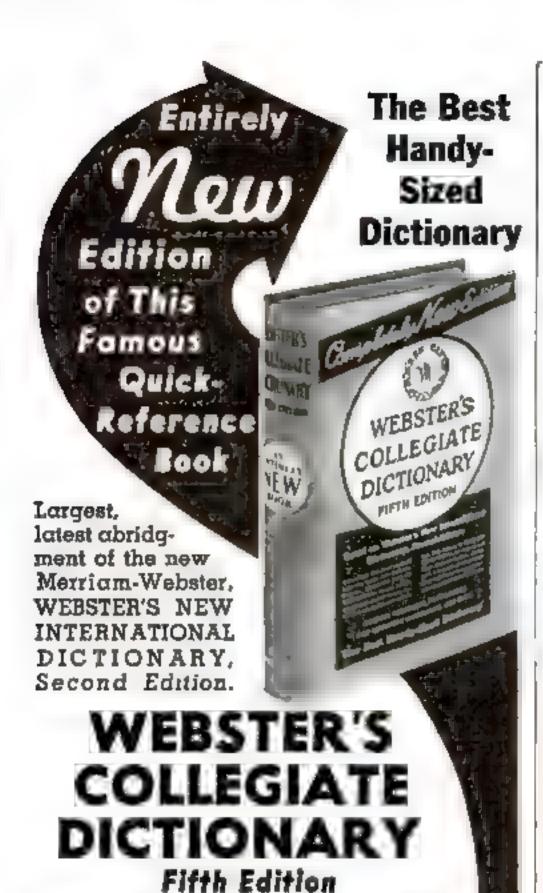
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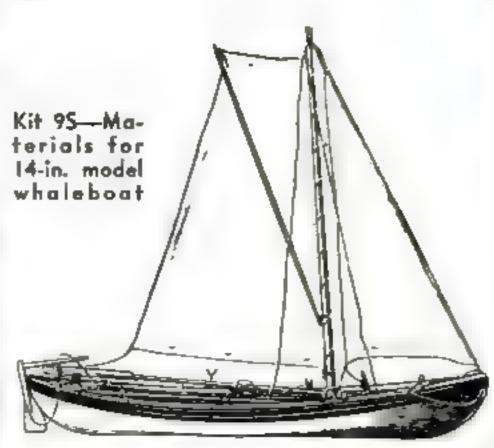
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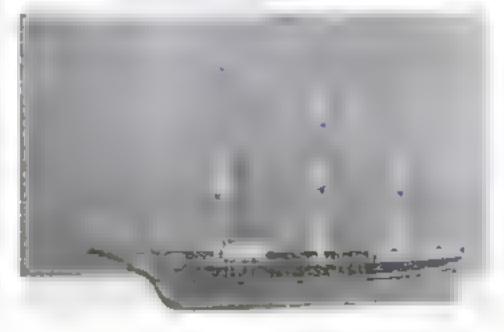
VERY lover of the sea who has thrilled to stories of whaling will enjoy building our new model of a whaleboat, illustrated above. It makes an excellent companion piece for the whaler Wanderer because it shows on an enlarged scale just how the small boats for such a ship were built and what they contained.

For the convenience of our readers we have prepared a construction kit for this model. It contains all the raw materials, including a partly shaped hull block, sailcloth, rigging, tubs, blocks, and the stock for making about fifty different pieces of equipment, many items being of a type difficult to obtain in local stores. The model may be mounted in several different ways so no special materials for that purpose are provided. The kit is listed as No. 9S and costs \$2.75 (for shipment west of the Mississippi River and to Canada, add 25 cents). An accompanying blueprint shows all parts full size.

Many other kits for making ship models, furniture, and whittled novelties are available. The complete list follows:

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- E. Battleship U.S.S. Texas, 3-ft..... 7.45* G. Elizabethan galleon Revenge,
- 25-in. hull, 28 in. over all.......... 7.25* L. Farragut's flagship Hartford, steam-and-sail sloop-of-war, 331/2-in. hull, 41 in. over all. 8.45*
- Q. Privateer Swallow, 121/2-in hull, 20 in. over all...... 4.95† (Continued on page 22)



Kit J-Clipper Ship "Sea Witch"



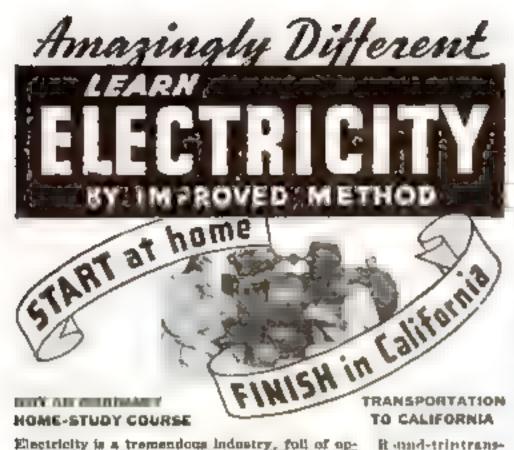
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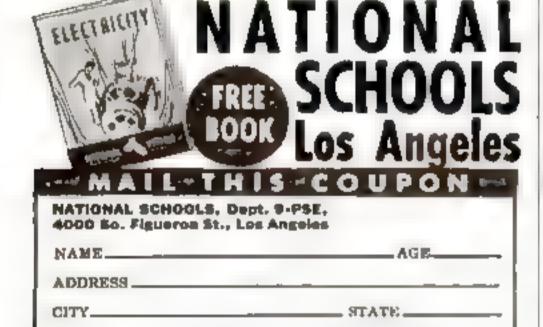
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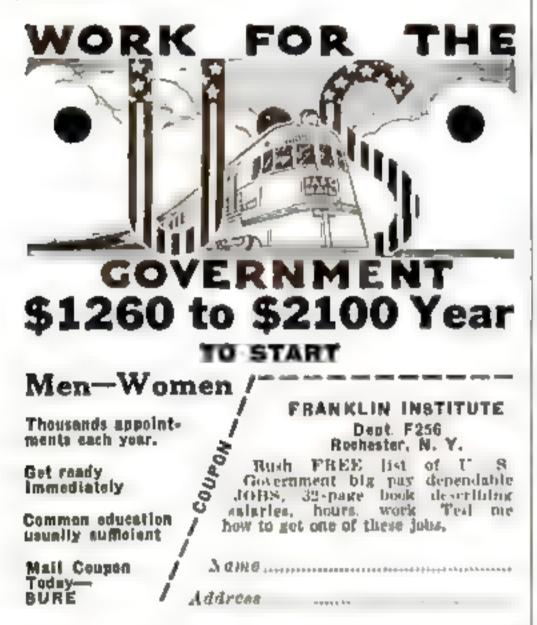
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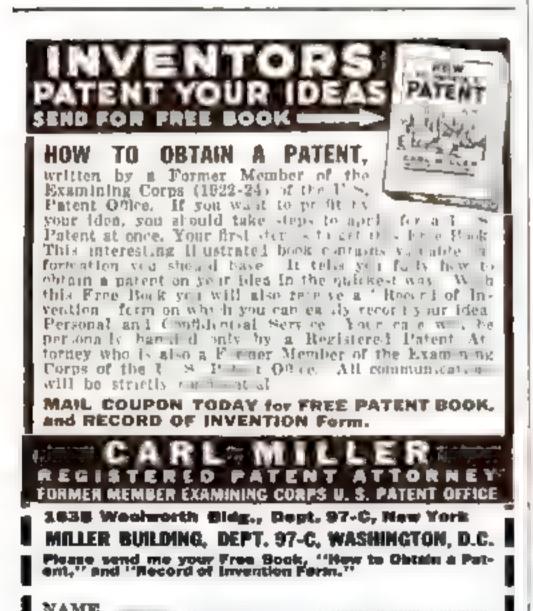


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Our Construction Kits

(Continued from page 21)







Kit A-Model of wholing ship "Wanderer"



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Our Construction Kits

(Continued from page 22)



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Z. H.M.S. Bounty, 111/2-in	. 1.50
1M. Show boat, illuminated, 1-	
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No. 7. Whittling kit with two shaped blocks for making sea captain 51/2 in. high. A knife, three bottles of paint, pocket sharpening stone, and instructions are included...... 1.50

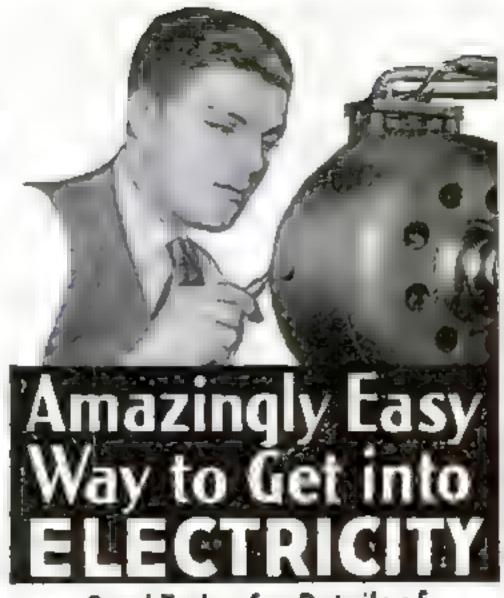
No. 8. Whittling kit for six different Scotties. Each is 2 by 21/4 in., sawed to shape. Paint, paintbrush, sharpening stone, and instructions are included...... 1.00

No. 9. Whittling kit with shaped block for making a sailor 54 in. high. Paint, brush, sharpening stone, and instructions are in-

No. 10. Copycraft whittling kit for making one of several Hobo Hank novelties. Contains a master model of tramp's figure, 5% in. high; whittling block, extra wood for making a desk set, pipe rack, or other project; sharpening stone, brush, three bottles of paint 1.50

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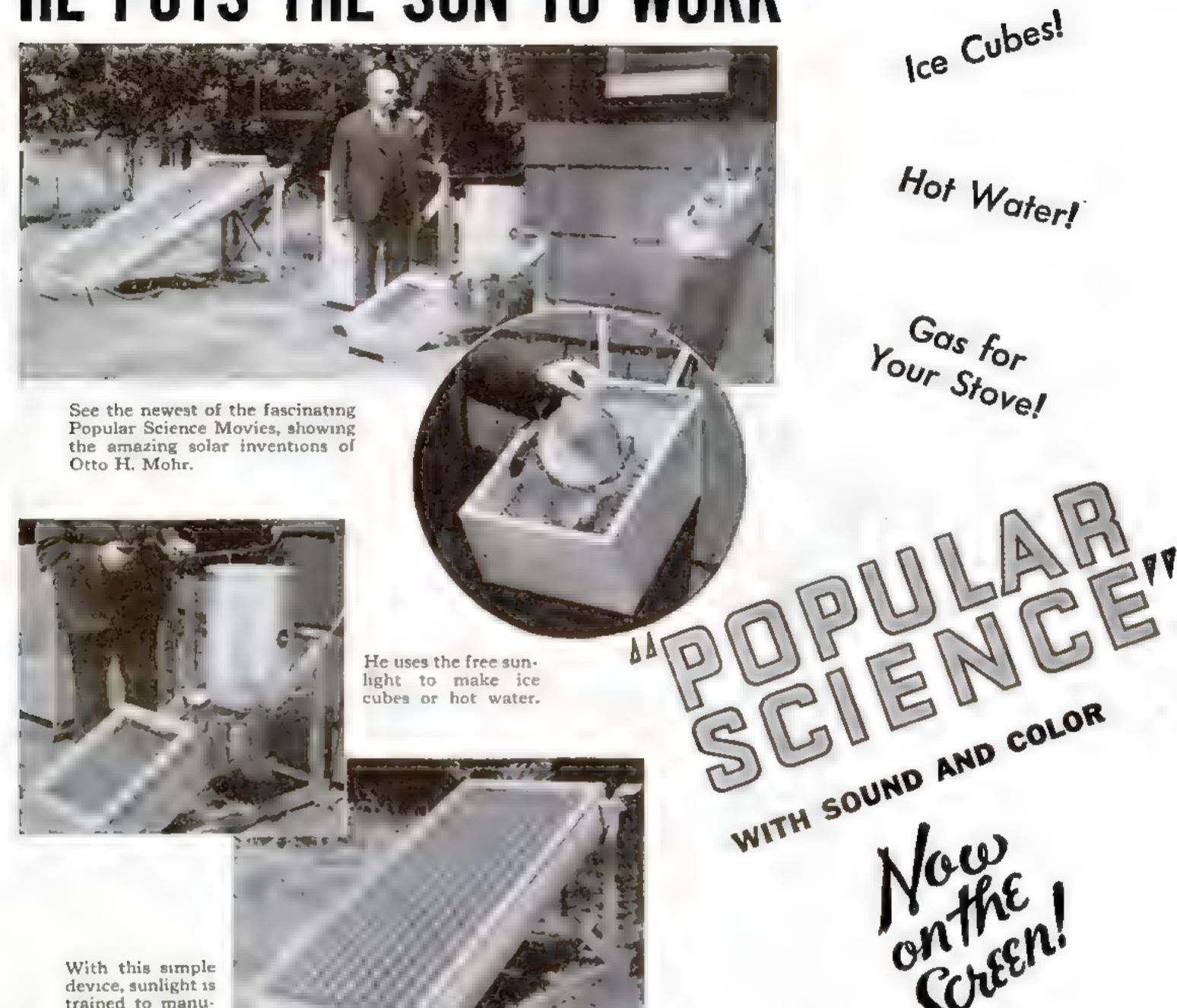
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SCIENCE

SEPTEMBER, 1937

VOL. 131 No. 3

WN, Editor



HE greatest air race of history is on-the race of nations for the skyways of the future.

Pioneer air lines ran from city to city. Later ones connected country with country. Now, there is an exciting international scramble for longdistance aerial routes which will span oceans and hurdle arctic wastes to link continent with continent. Half a dozen governments are staking out superskyways along which a far-flung aerial merchant marine will transport mail and freight and passengers.

Out of a rainy sky, not long ago, a slim-winged Russian monoplane dropped down on the Vancouver, Wash., airport and rolled to a stop. For sixty-three hours, its three-bladed propeller, spun by a single 950-horsepower engine, had pulled it through the air. During that time, the machine had pointed its nose up the globe from Moscow, had soared above 1,500 miles of arctic ice, had crossed the north pole, and then had taken the downhill path across the vast tundras of northern Canada, over Alas-

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ka, and along the coast to Vancouver. By this 5,388-mile flight, three Russian airmen, Valery Chkaloff, Georgi Baidukoff, and Alexander Beliakoff, blazed a spectacular new sky trail across the top of the world. They had achieved, in fact, a journey such as Jules Verne might have depicted in fic-

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across open water, and

climb up on drifting floes,

pole, Russian airmen expect to es tablish air lines from Moscow to Chicago and New York. The Soviet engineers who designed the Moscow-Vancouver machine are planning bigger, faster ships that will have sufficient range to reach the eastern cities by way of the north pole. While this spectacular enterprise is making aviation history, news flashes from other countries, from England, from Germany, from varlous parts of the United States, tell of innovations in planes, engines, and equipment designed for use on super-airways. Pan American clipper ships are surveying a new Pacific route to New Zealand; British Imperial Airways flying boats are exploring the great circle route over the One of the two German seaplanes that are flying the Atlantic on the southern route. They are launched from

ships, as illustrated

plies. Each of the lonely outposts would

carry an extra supply of fuel to help

the transpolar planes in an emergency.

Tests have shown that machines

By heading eastward from the

can safely land on the arctic ice.

These daring Soviet flyers

crossed the north pole while

on their 5,388-mile flight



The British Imperial Airways flying boot Caledonia, built to cooperate with an American clipper ship in blazing a transatlantic sky trail along the "great circle" course flown by Linabergh

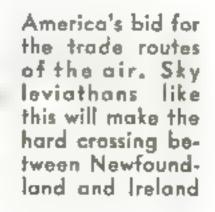
north Atlantic; sleek seaplanes of the Deutsche Lufthansa are shuttling back and forth between the Azores and New York on a schedule that calls for eight round-trip flights this summer. Intercontinental flying is taking a rapid stride forward.

Heading south from Honolulu, Hawaii, recently, a Pan-American twenty-two-ton clipper ship jumped 1,100 miles to Kingman Reef, 1,600 miles more to Pago-Pago, and a final 1,800 to Auckland, New Zealand. Regular service over the 7,000-mile route from San Francisco "down under" to Auckland, is expected to begin within a few months. It will clip more than two weeks from the required traveling time. Ocean vessels take nineteen days to make the journey; the winged boats will complete it in four.

Built secretly at the Boeing plant in Seattle, Wash., six of the largest airand-water craft ever designed are nearing completion. They will weigh almost fifty tons apiece. Seventytwo passengers and a crew of eight will ride in the sky lmers. Fifteen tons of fuel will give the ships a cruising radius of 5,000 miles. Four engines of new design, each having fourteen cylinders and costing nearly \$1,000 a cylinder, will power the big ships over the Atlantic on a new air line linking Europe and America.

It is on the Atlantic that competition for routes and terminals is keenest. By a recent agreement, Pan American Airways and the Imperial Airways, of Great Britain, will co(Continued on page 136)







By ALDEN P. ARMAGNAC

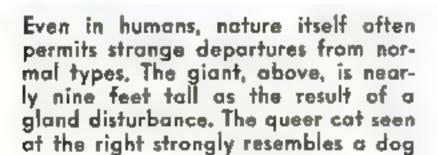
RE the apes really cousins of ours? While other scientists still search for a "missing link," Soviet experimenters have laid plans to create one to order, in a way that rivais the most fantastic fiction. Journeying to the wilds of Russian Turkestan, they have set up a laboratory for an attempt to produce a living hybrid between a human being and a chimpanzee!

They are not the first to propose an experiment that, if successful, would set the scientific world agog. Dr. Hermann Klaatsch, German biologist, seriously put forward the idea of crossing hardy

African natives with gorillas to obtain strong-muscled, weak-minded "robots" that could be exploited more readily than human laborers. An American scientist, Dr. Howell S. England of the Michigan Academy of Science, Arts, and Letters, originated the Soviet plan of hybridizing men and monkeys for the purely scientific purpose of proving their kinship, with the ultimate hope of producing a complete series of specimens grading from the perfect anthropoid to the perfect human. Misfortunes, including the death of their leader, have delayed the Russians' tests, and a German experimenter, currently attempting to produce a hybrid between a human being and the little Rhesus monkey, has become their rival for the distinction of creating the first ape-man.

Strange animals, not to be found in textbooks of natural history, already roam the earth as a result of man's experiments and nature's freaks. By mating a male tiger with a female lion, animal breeders have produced a remarkable beast called a "tigon," with only faint stripes of one animal and without the mane of the other. Hybrids that would puzzle any naturalist have been created by crossing horses and donkeys with zebras, dogs with foxes, and rabbits with guinea pigs. Interbreeding the buffalo and the domestic cow has yielded the rugged "cattalo," prized both for its meat and for the robes that can be made from its thick-haired, bisonlike hide. Separating sheep from goats may soon have more than figurative difficulty—for attempts to produce hybrids between them have succeeded!

Like the current ape-man experiments, many of these extraordinary



CREATURES made to order

ventures in crossbreeding have been made possible by the modern marvel of artificial or "test-tube" fertilization. No longer need animals be brought together to produce offspring; in fact, a new record for long-range paternity was set not long ago when an icepacked test tube containing a drop of vital fluid, dispatched by ordinary air post, enabled an ewe in Poland to give birth to an "air-mail" lamb sired by a ram in England! Through the same technique, animals that will not mate with other species of their own accord -and that includes most of them-can now be interbred with any creature in the zoo.

Each experiment is a fascinating adventure into the unknown. Only trial can tell whether a hybrid can be produced, what it will look like, whether it will be an animal useful to man, and whether it will prove sterile, like the mule, or capable of reproducing its kind, like the cattalo. The distinction of being the strangest hybrid ever created, from a biologist's point of view, probably goes to a tiny aquatic whatis-it—a cross between a sea urchin and a starfish, parents as remote in kinship as a fish and a mammal! It stretches a rule which nature applies more rigidly among the higher animals—that hybrids cannot be obtained between species too distantly related in the animal kingdom. You can cross a lion and a tiger, two members of the cat family, but not a cat and a dog.

It was a first-class zoölogical mystery, when something that did look amazingly like a cat-dog hybrid appeared among a litter of kittens born to a pet cat in Wilmington, N. C., a few months ago. The queer animal had a face like a puppy's, short hair, and a stub tail. It sat up like a dog, and sniffed food and gnawed bones in truly canine manner. Despite appearances, experts decided that the curious creature was "all cat"—and an unusually interesting one. Apparently it was one of those rare, sudden "mutations," or spontaneous departures from normal type, that many biologists believe play a vital role in the improvement of a race by evolution—the out-of-the-ordinary individuals perpetuating their kind if the change is for the better, and losing out in the struggle for existence if the change is for the worse.

Not long ago, a calf was born with two heads, two tails, and six feet, of which two grew out of its back. Once

the appearance of such a "prodigy" would have excited superstitious awe. Today, the things that produce creatures with extra heads or legs, roosters that lay eggs, and giant animals and dwarf ones, are coming to be understood, and such freaks have

even been created artificially. Twoheaded "monstrosities," like Siamese twins, have been found simply to be twins that failed to separate completely. One scientist took the developing egg of a newt, a small lizardlike salamander, and separated it into two halves by binding a thin hair about its middle. Twin newt tadpoles of normal appearance hatched from the divided egg. He then took another egg and tied it with a hair so that it was only partially constricted at the middle. The result was a single tadpole with two heads. Disorders of the endocrine or ductless glands may produce glants, dwarfs, and other freaks whose peculiarities likewise are not inheritable but are simply individual physical deformities.

Freak animals arising from any one of these various causes may easily have inspired some of the famous tales of mythical monsters—the many-headed Hydra, the one-eyed Cyclops, and the fearsome basilisk, dragon, chimera, and griffin! Among imaginative and credulous people, such a story would gain in repetition, until the "monster" was magnified out of all proportion to what an eyewitness might actually have seen.

Nature-fakers, too, have started animal myths. Curios fashioned from the dried torsos and heads of monkeys, skillfully attached to the dried tails of fishes, keep curators of museums and aquariums busy denying the existence of mermaids. The human-looking fakes have been manufactured from the earliest times, and probably account for the

illustrations of halfhuman "fish," garbed as bishops and monks, in ancient natural-history books, according to Dr. E. W. Gudger of the American Museum of Natural History, "Dragons" and "basilisks" have been made artificially from big ray fish by carving and manipulating the head and fins, and a "fish with a human face" reported caught at Asbury Park, N. J., only a few years ago was a similar hoax.



The "tigon," half lian and half tiger. It has only faint stripes and, though a male, lacks the lian's mane

Two-headed creatures, like the turtle at the left, are merely twins that did not separate completely





DESIGNED for airplane use, a "balloon" chair, compactly

stowed in a duffel bag, can be expanded into a comfortable plane seat by inflating it with air. No bracing is needed to give rigidity to the rubberized fabric chair.

Tiny Lamps in Glasses Cast Light

Novel eyeglasses, for use at night or in dark rooms, provide their own illumination. Recently invented by a Japanese optician, the glasses have tiny bulbs mounted in reflectors surrounding the lenses and connected by an inconspicuous wire to a pocket dry-cell battery. When switched on, the flash-light



Bulbs are mounted in the circular reflectors

glasses throw their rays in the direction along the wearer's line of sight, thus enabling him to read or move about in an otherwise darkened place.

Portable Device Scores Bombing Practice

EASILY transported, a new camera obscura just developed for "bombless" airplane bombing practice is a portable model of the fixed type used at permanent training sites (P.S.M., Dec. 1935, p. 34). Housed in a cylindrical structure that forms the plane's target, the camera projects an image of the bombing plane on a chart to check the bomber's aim by determining the plane's position when it released the theoretical "missile." The portable unit permits varying the scene of bombless practice.



Camera obscura in use for "spotting" theoretical hits by Army bombers



Farthest north in scientific observatories: the camp of Russian meteorologists on the polar ice pack

Scientists Encamp at North Pole

Russian aerial explorers are shown at the base they recently established at the north pole in the photograph reproduced at the left, which was brought back by a plane bearing returning members of the expedition. Four expedition members are remaining at this arctic camp for a year's study of climatic and atmospheric conditions. Their base rests on floating ice.



A workman laying a rubber expansion unit in a concrete road. The close-up at right shows the nonslip flanges

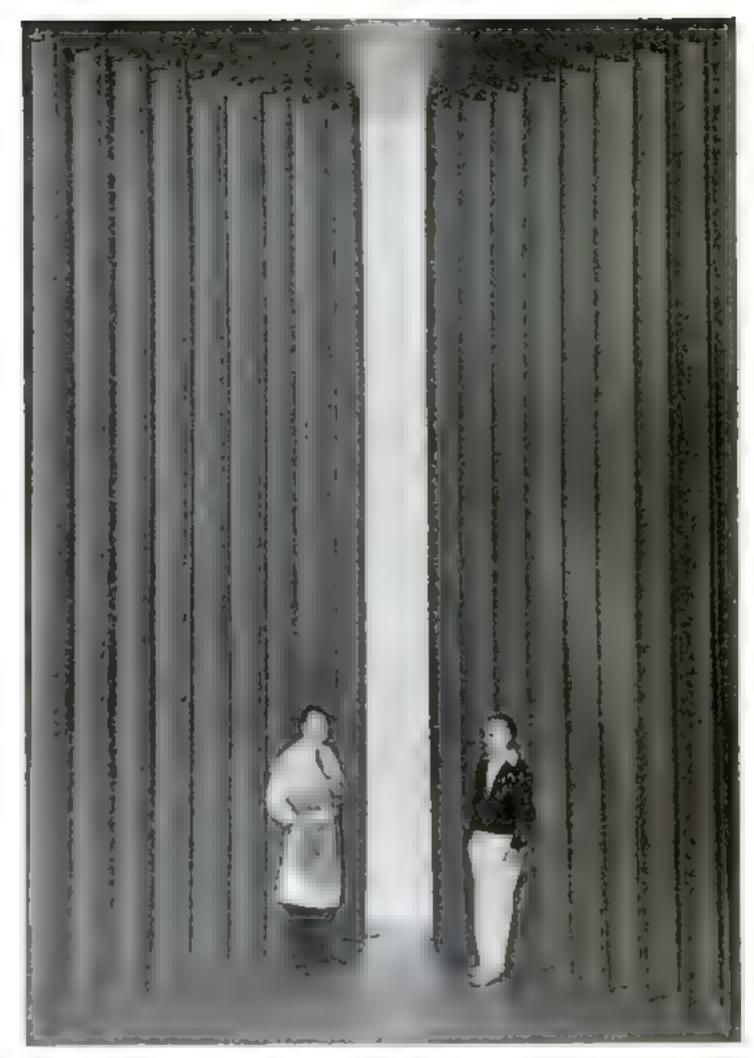


Flexible Strips Seal Joints in Concrete

COMPRESSED between the joints of a concrete road, a rubber expansion unit just announced is said to eliminate the repair work now required on conventional cement-composition joints. Filling the space between concrete sections, the rubber joints have flexible lips to prevent them from working upward and projecting above the pavement level.

Water Cools Vanes for Wind Tunnel

A GIANT wind tunnel for testing airplanes, now under construction by aeronautical experts at the University of Washington, Seattle, Wash., will have a novel water cooling system for the huge vanes used to deflect and control the direction of the tunnel's air stream. The twenty-foot fins have hollow centers through which a constant stream of cooled water will be pumped to protect the metal deflectors from the intense heat of friction created by the mile-a-minute gale blowing through them. The vanes are pictured in the photograph at the right in comparison with two University of Washington professors to show the mammoth size of the deflectors.



Giant deflectors in a new wind tunnel for testing airplane design



Old Sleeping Cars Make Novel Restaurant

COATED with gleaming aluminum paint, two old sleeping cars placed parallel to each other and joined by an arched building, form a novel restaurant in St. Paul, Minn. The forward ends of the cars were remodeled to resemble the noses of streamline trains. At the left, workmen are seen putting the finishing touches on the novel "diner."

Troops Ferried Across River by String of Rubber Rafts

INFLATED rubber rafts towed by a motor launch were used in recent German military maneuvers to ferry troops across a broad body of water. The novel transportation system is adapted to moving soldiers across lakes and rivers too wide to be spanned by pontoon bridges.



German infantrymen being transported across a wide body of water in inflated rubber rafts toward by a motor lounch during recent maneuvers

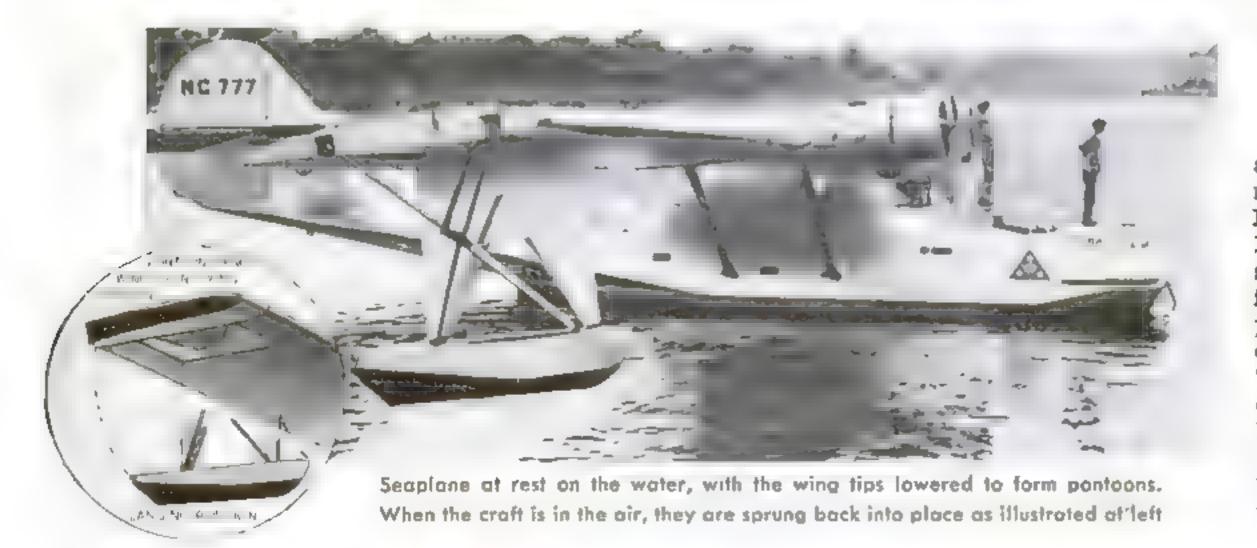
Handmade Wind Wafts Tiny Yachts

MINIATURE-SAILBOAT enthusiasts in California do not wait for favorable sailing winds. As pictured above, they create their own breeze by waving fans, and wade across the pool to blow their craft to the finish line on the other side.

Truck Lubricates Trolley Wires

Overhead trolley wires are lubricated to cut down wear by a special truck just placed in service in England. Aluminum containers at the ends of poles extending upward from the truck top feed a lubricant to revolving wheels that transfer it evenly to the wire surface.



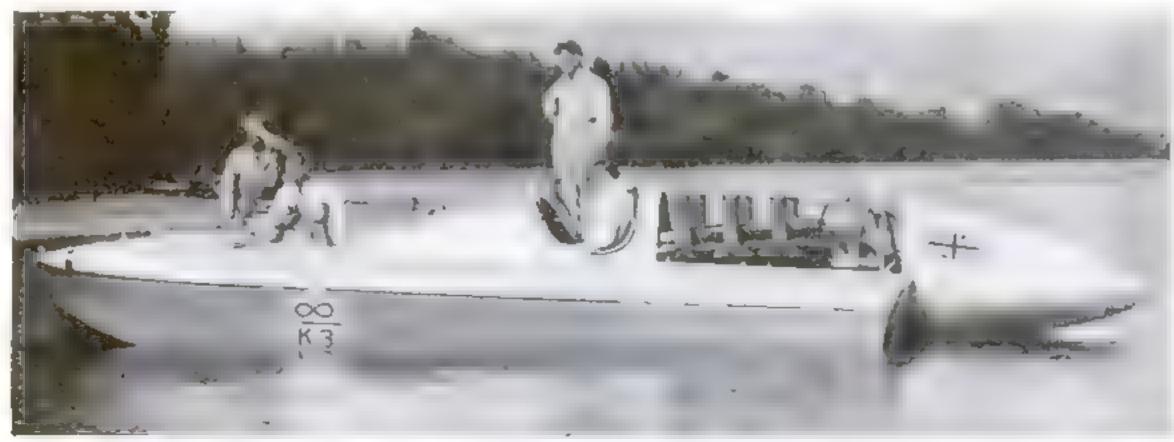


Speedboat Has Pointed Stern

A STREAMLINE stern is an unusual feature of a new speedboat built for Sir Malcolm Campbell, famous English automobile speedster, who is now attempting to set a record for power boats on the waters of Loch Lomond, Scotland. The torpedo-shaped stern of his craft is expected to have a stabilizing effect by its action on the air as the boat races over the water at high speed.

Plane's Wing Tip Forms Pontoon

Wing tips and pontoons are combined in one hinged unit on a new seaplane that recently made the first transcontinental flight ever accomplished by a flying boat. When landing or taking off from the water, the wing tip is lowered and supported by metal struts to act as an outrigger pontoon. In flight, the pontoon flattens out to form part of the wing.



Sir Malcolm Campbell's new speedboat on Loch Lomand, Scatland. Note the odd, streamline stern

Topsy-Turvy Seesaw Is New Amusement Thriller

A NEW thriller for amusement parks has been designed by a Russian inventor. Strapped in a seat at the end of a counterweighted steel arm, the solitary passenger is repeatedly swung in a giant semicircle with head and feet alternately uppermost.

Radio Device Charts Plane's Flight

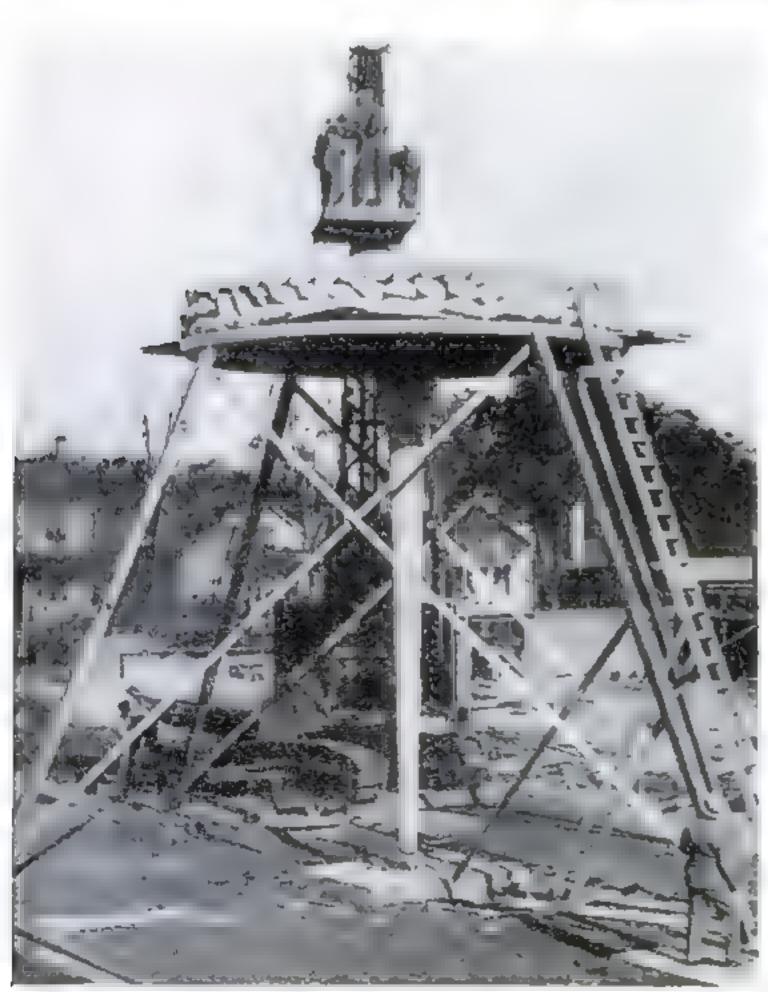
RECENTLY tried out for the first time under practical flying conditions by a transcontinental air line, a new indicating device enables a dispatcher in an airport office to keep track of the location of a transport plane at every moment of its journey.

Aboard the plane a portable radio transmitter sends out special signals at regular intervals. Picked up at the ground station, these signals automatically control the movement of an illuminated spot, representing the plane, across a circular air-line map. The telitale light shows whether the pilot is on his

proper course and provides an accurate, continuous indication of this progress, according to the inventor of the device, Dr. Samuel Spitz of Burbank, Calif. If current tests prove successful, the device may find widespread use in commercial aviation.



A spot of light traces a plane's course on the circular map. Left, pilot installing transmitting unit



Twenty tons of sandbags failed to crack this inverted-taper column



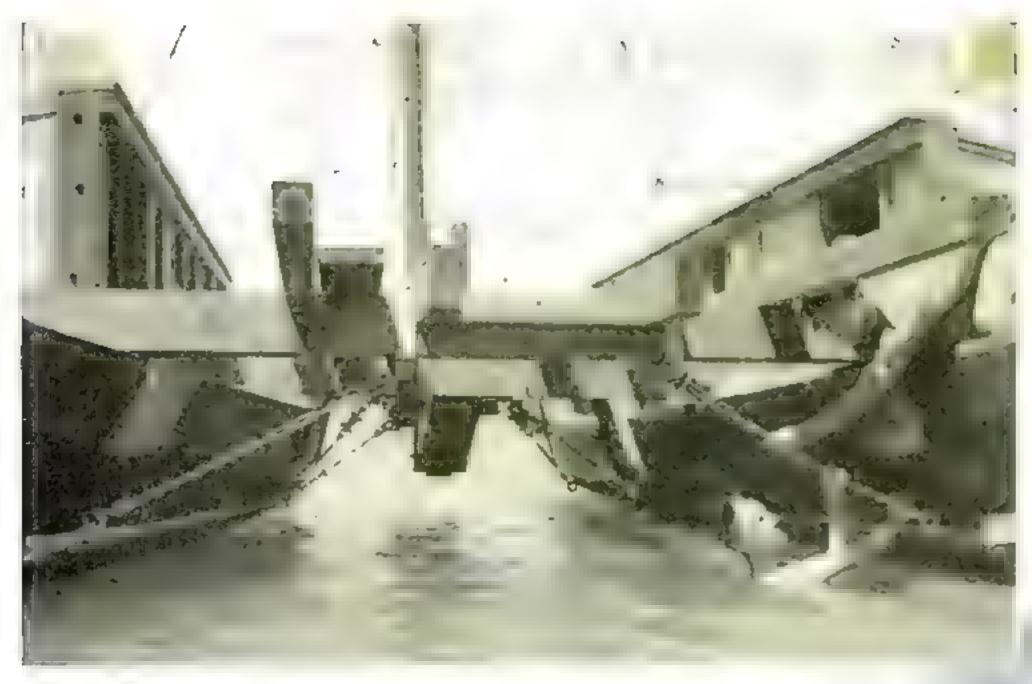
Towen wherever it is needed, a compact trailer of German design unfolds into a complete workshop for repairing automobiles, marine motors, and other machinery. The equipment provides an oxy-acetylene welding outfit, a drill press, grinder, and buffing wheel driven by a rear wheel of the tow car.

Odd "Upside-Down" Pillar Tested

While workmen piled sandbags upon a platform supported by an architectural pillar of new shape, in a testing lot at Wauwatosa, Wis., engineers looked on to see whether the column would collapse. When the weight upon it reached twenty tons without even producing a crack, they pronounced it safe. The new "upside-down" pillar, tapering contrariwise to the usual direction, was designed by Frank Lloyd Wright, noted American architect, for use in an industrial building.



way of the Malay archipelago to Samoa and



Adventurers Brave Ocean
Trip in a Crude Boat to
Test Theories of Ancient
Migrations of Polynesians

Patterned after boats used by Pacific islanders centuries ago, the twomasted cance consists of twin hulls, joined together with stout timbers

Hawaii. Prevailing east-to-west winds and ocean currents make such a voyage inconceivable in the frail craft they had at their disposal, the French scientists maintain, holding instead that they came from Central and South America with the aid of favoring trade winds.

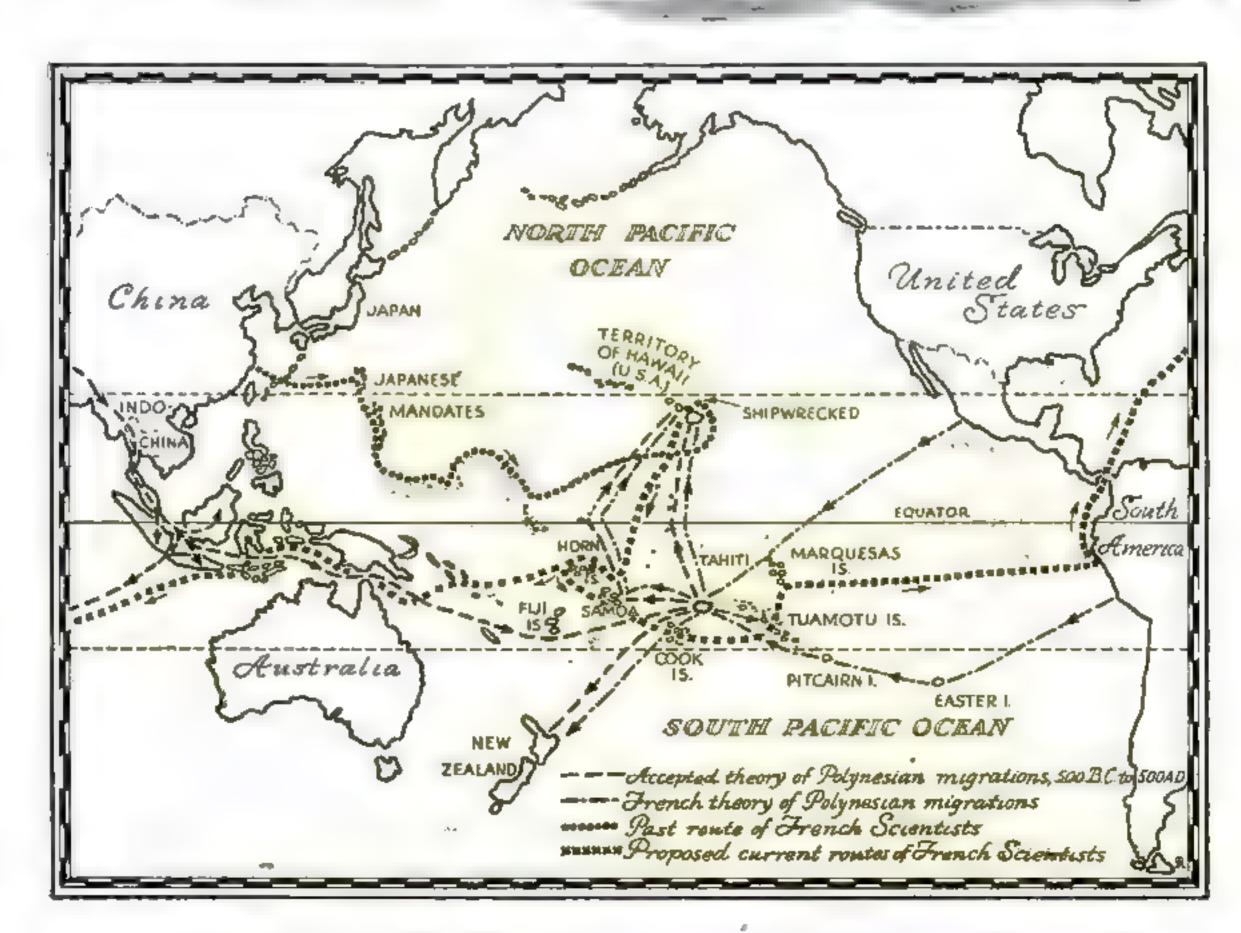
Seeking to trace the Polynesians' migration and the spread of their culture through ancient relics, the scientists passed two perilous years sailing among the islands of the Japanese Mandate group and thence to Hawaii. The journey ended in disaster when their small craft was wrecked upon the almost-unexplored shore of a Hawaiian island. Rescued at the point of starvation, the seafarers devised a new ven-

ture to demonstrate more dramatically the route that the mysterious brown race may have taken.

Mainly with their own hands, the two men spent a year building their present vessel, the Kamiloa, a thirty-fivefoot double canoe like the ones that the Polynesians used. When it was completed, its two sloping masts carried primitive sails made of matting. Exceptionally heavy timbers braced the craft against the strain of grounding on an uncharted reef. Then the scientists set forth in an attempt to sail home to France!

From the Horn Islands, their first objective, they plan to continue by one of two alternate routes—eastward through the Panama Canal, or westward by way of the Cape of Good Hope. "If we can make headway against wind and currents in such a craft as

this," the adventurers declared as they started.out, "then perhaps the ancient tales of tremendous eastward journeys may be true." So far, they have averaged eixty miles a day, and acientista seeking light on the long-standing riddle of the Polynesians will watch their further progress eagerly.



Route taken by the scientist-sailors. So far, they have traveled 2,760 miles in their odd craft

Perfect eyes are an important factor in efficient reading. Below, a child being tested with the ophthalmograph, an instrument that records the movements made by the eyeballs in reading Ву

read? Using a new eye camera, optical experts and educators can quickly test your ability. If faults are revealed, a companion device will train your eyes to read correctly. First of their kind that are portable and inexpensive, the instruments are expected to benefit countless persons unknowingly handicapped by defective reading habits.

JOHN E. LODGE

OW efficiently do you

Only one person out of four reads efficiently, Judging by the time he takes to scan a page and grasp the ideas it contains, according to the Southbridge, Mass.,

optical firm that has developed the devices. Tests of 3,000 subjects show that the reading ability of the average American just measures up to that of a normal sixth-grade schoolboy. What makes this a startling indictment is the fact that today we are devouring an enormous and ever-increasing mass of printed material. Periodicals going into the American home have increased 170 percent in volume since 1900. The

Samples of the cards used in the new tests. The text matter is adapted to subjects of various ages

box for a table

typewriter and other business machines have made it necessary for workers in many offices to read 500 percent more than in the past. College students are reading five times more, and publicschool pupils fifteen times more, than at the turn of the century. Never before was it so important to learn to read correctly, for both pleasure and profit.

Jane has fire dolls

books One morning . school under like graan

Her dolls were the chudren Jane

Race rach doll a book. She until a

Why some readers are better than

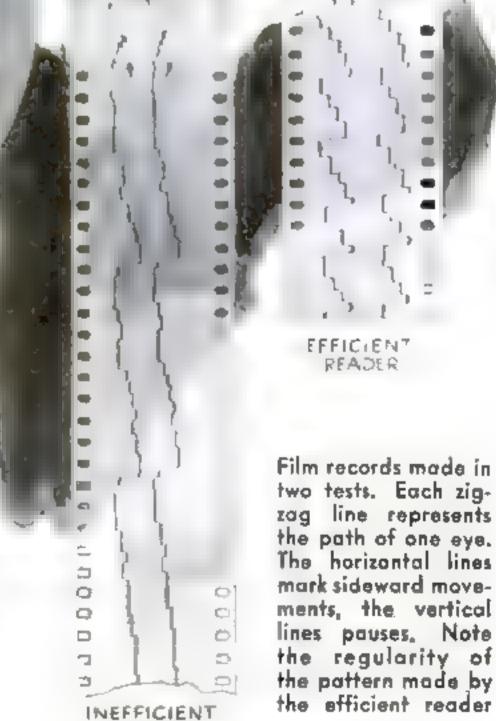
DoYou

others has been discovered through photographic tests. Normal eyes move along a printed line in a series of swift jerks, pausing at intervals to focus on a word or group of words. If you are an efficient reader, your eyes may halt eight times in reading a ten-word sentence. Those of an inefficient reader may pause as many as fifteen times-and even retrace their path from time to time, to pick up something they have missed, instead of sweeping steadily ahead. This was the essence of information gathered with expensive and bulky laboratory apparatus, in some cases costing as much as \$4,000 to assemble.

The compact new eye camera, designed on the same principles and called an ophthalmograph, tells you which class you belong to in less than five minutes' time. It weighs but thirty-five pounds. Making from fifty to seventy-five eye tests upon a 100-foot strip of standard motion picture film, at a cost of only five to fifteen cents apiece, it shows exactly how your eyes behave when you are reading.

For a test, the subject gazes into the machine at a printed card bearing a paragraph of text. While he reads it, beams of light are projected at his eyeballs and reflected from them upon a moving strip of photographic film. The result is a permanent record of the movements of both eyes—a pair of zigzag lines resembling a double stairway. Each horizontal line corresponds to a sideward shift of the eye; each vertical

> line, to a pause. Thus the number of pauses in reading a given line can be immediately determined, and any backward movements detected as well, while the length of time it took to read the printed card is shown at once by



READER

zag line represents the path of one eye. The horizontal lines mark sideward movements, the vertical lines pauses. Note the regularity of the pattern made by

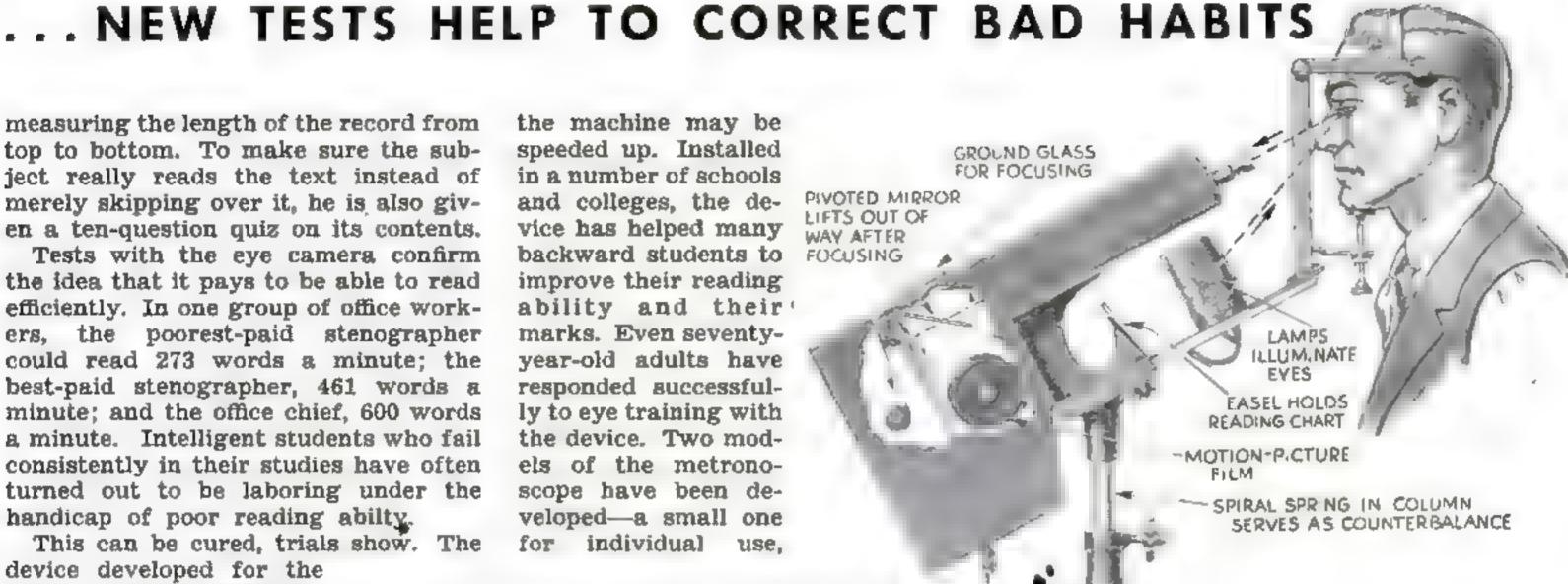
Know How to Read?

measuring the length of the record from top to bottom. To make sure the subject really reads the text instead of merely skipping over it, he is also given a ten-question quiz on its contents.

Tests with the eye camera confirm the idea that it pays to be able to read efficiently. In one group of office workers, the poorest-paid stenographer could read 273 words a minute; the best-paid stenographer, 461 words a minute; and the office chief, 600 words a minute. Intelligent students who fail consistently in their studies have often turned out to be laboring under the handicap of poor reading abilty.

This can be cured, trials show. The device developed for the purpose, called a metronoscope, trains the eyes by forcing them to read correctly. Across a horizontal viewing slot in a boxlike cabinet placed before the subject, an electric motor draws a wide paper strip, resembling an oversize player-piano roll and bearing printed text. Three shutters open and close in turn, from left to right along the slot, exposing one-third of a printed line at a time. The subject's eyes are thus obliged to keep pace. They cannot turn backward for a second look, for the shutters obliterate the words as fast as new text comes into view. As the subject's proficiency grows,

the machine may be speeded up. Installed in a number of schools and colleges, the de- PIVOTED MIRROR vice has helped many backward students to FOCUSING improve their reading ability and their marks. Even seventyyear-old adults have responded successfully to eye training with the device. Two models of the metronoscope have been developed—a small one for individual use.



Test Your Reading Ability

Read the 100-word paragraph printed below at your normal speed while a friend times you with a watch. Then turn to page 119.

A man who weighs 200 pounds on the street weighs only 199.8 pounds at the top of the Empire State building in New York City. This is the odd conclusion that may be drawn from a two-day series of tests recently made in the 1,285-foot building by three scientists representing the American Geophysical Union, the United States Coast and Geodetic Survey, and Lehigh University. Using precision instruments designed by a Dutch scientist, the experimenters made twenty observations in a freight elevator in a new attempt to determine how much the force of gravity varies with height above ground.

How the ophthalmograph works. Lights reflected by the eyeballs trace lines on the film to show movements of the eyes

and a large one that a whole class or group can use at once.

"Reading clinics" for the general public, equipped with the new instruments. are springing up all over the United States-in Chicago, Ill., Oswego, N. Y., Brownwood, Texas, and at New York University in New York City, to mention a few. Bankers, engineers, doctors, office workers, and housewives come in regularly to learn how to read efficiently. Recently, the chairman of the board of directors of one of America's largest cor-

porations appeared for a reading test, explaining that he was continually embarrassed at having to take twice as long as his colleagues to read financial and business reports. A series of "treatments" with the metronoscope more than doubled his reading speed.

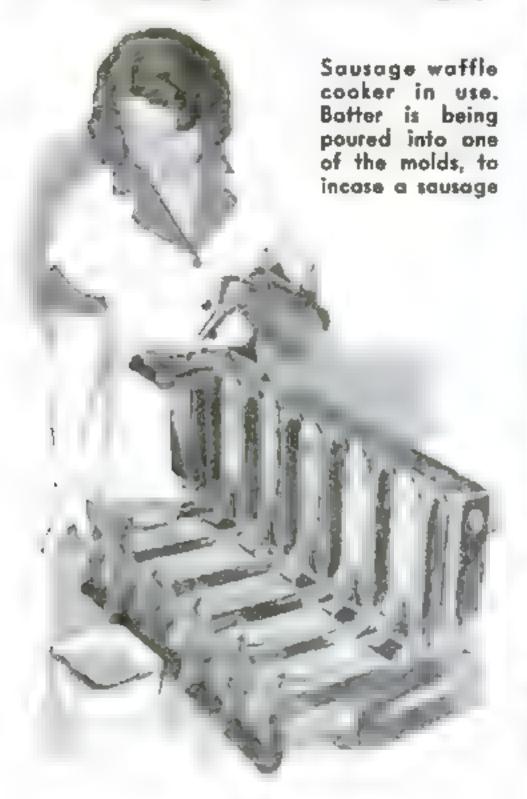
Thousands of tests with the new devices are revealing queer and fascinating facts about reading. Most people read the left side of a line more carefully than the right, and this is why proofreaders overlook more errors at the end of a printed line than at the beginning. "Lip movers" are handicapped because they can read only as fast as they can talk. An average sixthgrade pupil can read 200 words a minute, a high-school student 295 words, and a college man 325 words. Experts believe that an abnormally large "macular area," the region of greatest sensitivity in (Continued on page 119)

A companion machine, the metronoscope, which corrects bad reading habits. The boxes contain additional printed rolls



Cooker Bakes Waffle Around a Sausage

WAFFLES are baked around sausages in a new electric cooker. After a sausage is placed in an open mold, the latter is closed, and batter is poured in to be baked around the meat. At the same time, the sausage is cooked thoroughly.





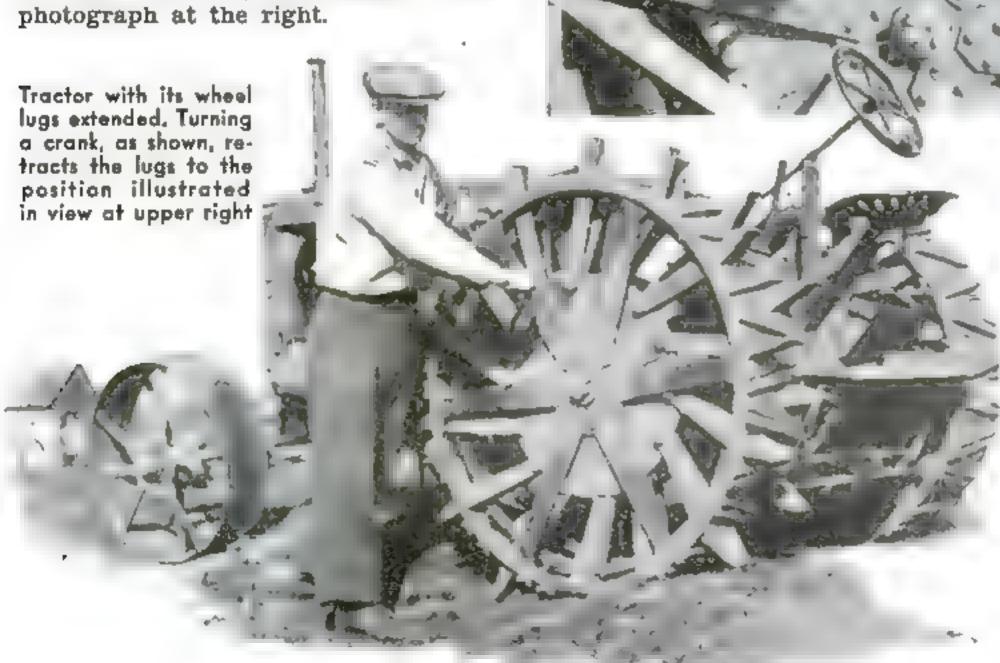
Trailer Trains Cruise Paris Fair Grounds

STREAMLINE trailer units, coupled like a train of railroad cars to a driving cab powered by a gasoline engine, transport visitors around the extensive grounds of the International Exposition in Paris, France. Each four-wheeled car carries

six persons, and the automotive train can be adapted to the number of passengers desiring to ride, merely by hitching on additional sections. In the photograph above, three trailers are shown coupled to the power unit.

Tractor-Wheel Lugs Are Retractable

RETRACTABLE lugs for tractor wheels have recently been invented by a Wisconsin farmer so that cultivating machines can operate efficiently and economically under any conditions of load or running surface. The spiked lugs are pivoted at the edge of a circular metal plate inside the tractor wheel. Turning the inner plate with a crank projects the lugs out through slots in the wheel surface, as pictured below, or draws them in, as indicated in the photograph at the right.



Plane Passengers Get Telephone Service

TRAVELERS on a western air line can now telephone to any part of the country, or even abroad, while their plane is in flight. When a hand-set phone is plugged into an outlet near the seat, a passenger talks by shortwave radio to a ground station, from which the call is relayed to a near-by telephone exchange and connected to the regular telephone system.



A plane rider receiving a telephone for a call



Boxing Cats Stage Odd Prize Fight

TRAINED to spar and feint like prize fighters, a pair of boxing cats entertains patrons at a New York night club. The feline "leather pushers" wear gloves on their paws and carry out their act in a miniature, roped ring. Their trainer, Arthur A. Nelson, serves as referee for the novel matches.

Sand-blast Process Is Dustless

SAND-BLAST cleaning of buildings and metal castings is freed from the usual dust hazard by a new process that sprays water with the sand. No dust is raised, it is said, and the canvas cover employed for dry blasting is not needed to protect workers and passers-by.



Water sprayed with the sand lays dust created by blasting work

Electric Hairbrush Uses House Current

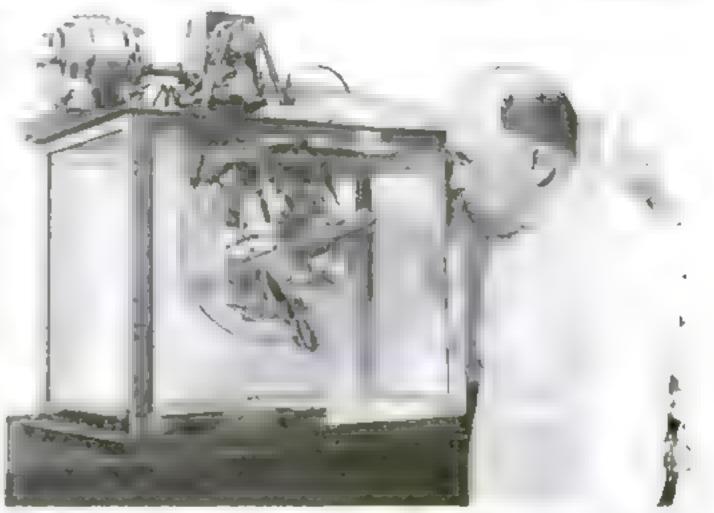
Plugged into any light socket, an electric hairbrush recently invented is designed to aid in maintaining a healthy scalp. Growth and beauty of the hair are stimulated, it is claimed, by the increased circulation of blood in the scalp that the brush induces. In addition, the device is held to be effective in relieving headaches by relaxing the nerves.

Engine Burns Two Fuels

RUNNING on either gasoline or heavy fuel oil, an airplane engine recently demonstrated in Europe is said to save thirty percent in fuel costs over conventional types. The heavy oil is not burned on the Diesel principle, but runs through a miniature "cracking" plant that breaks it down into volatile form.

Saliva Is Tested as Cause of Tooth Decay

TESTING saliva for its effect on tooth enamel. a device perfected by scientists at Northwestern University is part of a program to prevent tooth decay. A sample of the subject's saliva is sealed in a tube containing powdered human tooth enamel, and rotated for four hours in a water bath at body temperature. If a measurable amount of enamel is dissolved, it indicates that the patient's mouth condition favors tooth decay, and treatment is prescribed to remedy it.



Device for testing effect of a person's saliva on tooth enamel



A section of skidproof steel roadway being fastened to bridge floor

Steel Grille Is Floor of New Bridge

A HONEYCOMB grille of metal strips forms the flooring of a bridge nearing completion in Brooklyn, N.Y. The new deck is said to be lighter and easier to install than concrete, and to be practically skidproof. Snow sifts through the openings, thus eliminating the task of clearing the roadway in winter.

Bike Breezes Along With Sail and Propeller



Fish-Pole Rig Teaches Divers Good Form

DIVING is taught with the aid of an odd rigging just devised. Standing on the end of a springboard, the diving novice grasps a triangular handle. Ropes lead from the handle to the end of a long pole which is held by an instructor standing on the rim of the swimming pool. With a downward sweep, the teacher pulls his pupil head first into the water in correct diving position, as illustrated in the picture at the right.



Instructor using pole and ropes to teach correct diving position

PREVAILING winds are harnessed by a French cyclist who has fitted his bicycle with a sail. Mounted behind the saddle, the canvas opens out like a clamshell to take advantage of a following breeze. For traveling against the wind, an odd four-bladed propeller, extending in front of the handlebars and geared to the sprocket wheel, supplements the conventional chain drive.

Electric Toothbrush Also Massages Gums



A motor in the handle vibrates the brush

AN ELECTRIC toothbrush has just been marketed for home use. When plugged into an outlet, a motor in the handle of the unit vibrates a small circular brush which can be used for massaging the gums as well as for cleaning the teeth. Interchangeable brushes on extension arms of different colors permit use of the device by all members of a family.

Radioactive Gas Tests Masks

LEAKS in gas masks are revealed by minute quantities of a radioactive gas mixed with the vapors used in tests. If only a few molecules get into the mask, they are readily detected by electrical devices.

Camera "Fingerprints" Identify Diamonds



Watch Tells the Date

A CALENDAR that shows the day of the week for any date from 1929 through 1951 is built into the back of a new, inexpensive pocket watch. A table of numbers arranged like a conventional monthly calendar is adjusted for the month desired by a revolving rim.

LOST or stolen diamonds are easily identified if they previously have been "fingerprinted" by a novel photographic process recently perfected. Light rays are directed through a gem and fall on the camera film in a characteristic pattern. Because diamonds are cut in different ways, and each has individual flaws or defects, the "light print" of each stone is said to form a positive and infallible proof of its identity.



Apparatus used in identifying diamonds by individual light patterns



Umpire's Mask Has Built-In Microphone

To make an umpire's decisions audible to baseball fans throughout a large stadium, a recently invented umpire's mask, shown above, is equipped with a built-in microphone. A trailing wire connects the pick-up to a public-address system with several loudspeakers.

Fire-Box Siren Helps Prevent False Alarms

MOUNTED on a firealarm box, a shrill siren discourages the turning in of false alarms. When the switch is thrown to notify headquarters of a fire, the siren sets up a deafening wail that instantly draws the attention of passers-by to the person setting off the alarm so he may be identified if the alarm is false.



When an alarm is turned in, the siren on top of the box sounds

New Popular Science Movie Truck Goes to Sea

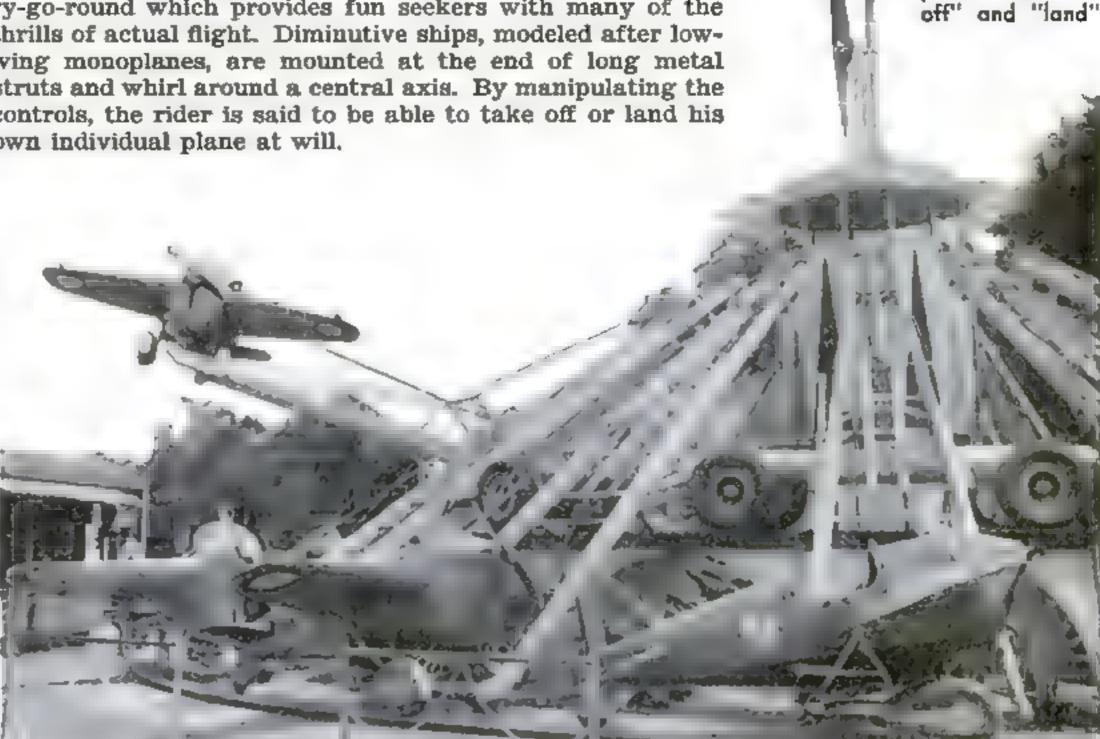


The new sound truck making its first "on-location" trip by steamer

HOISTED to the deck of an ocean liner, a new sound truck just completed for the producers of "Pop-**ULAR SCIENCE of** the Screen" made its initial trip by sea. The film laboratory on wheels has a built-in darkroom, a fivecab, passenger and a 300-ampere generator for operating its lightequipment. ing The new truck seven forhas ward speeds and can travel sixtyfive miles an hour.

Captive Planes Give New Thrill Ride AMONG the latest amusement devices is an airplane mer-

ry-go-round which provides fun seekers with many of the thrills of actual flight. Diminutive ships, modeled after lowwing monoplanes, are mounted at the end of long metal struts and whirl around a central axis. By manipulating the controls, the rider is said to be able to take off or land his own individual plane at will.



Lacquer Protects New Stamps

Passengers oper-

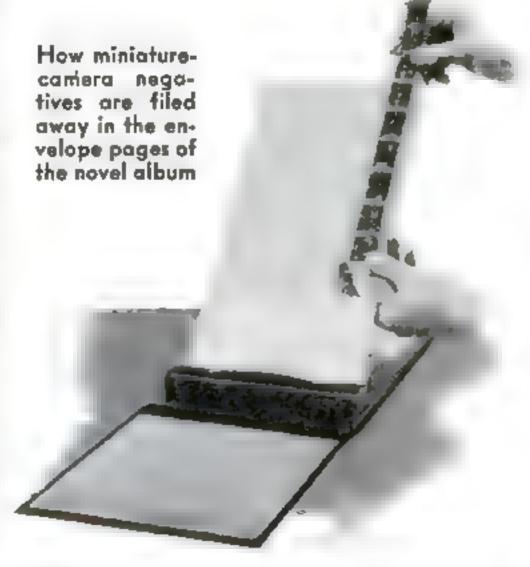
ate the controls of make-believe

planes to "take

To END the nuisance of stuck-together stamps, new English postal stickers will be provided with a coating of lacquer to protect the gummed surface. Although the coating will dissolve with ordinary moistening, it will prevent the gum from sticking in damp weather.

Dustproof Album Holds Miniature Negatives

NEGATIVES from miniature cameras are easily located when stored in a new loose-leaf file. A complete roll of thirtysix negatives can be slipped between the transparent, moisture-and-dustproof envelopes which form each page. A weighted cover holds the file contents flat, and paper inserts are provided on each of the forty pages for recording exposure data. When the book's capacity of 1,440 negatives is reached, additional pages may be inserted.





der determined to die by will power

to commit suicide with thoughts instead of bullets. Gradually she lost consciousness. Her arms and legs appeared paralyzed. For 110 hours, she lay in apparent coma before she was revived. It was a dramatic exhibition of the power of mind over body.

Turn through the pages of almost any physician's case book and you will find astonishing instances of the part psychology plays in illness and in health. Every one is familiar with the way shame makes us blush, fear blanches our skin, anxiety turns our mouths as dry as cotton batting. But some people react physically to profound emotional disturbances-worry, love tangles, the shock of a sudden fright or tragedy-in ways almost beyond belief.

Cases of paralysis, sudden blindness, curious skin diseases, goiter (enlargement of the thyroid gland at the front of the neck), and a whole variety of physical disabilities have been traced directly to mental upsets. The death of his wife in an accident so preyed upon one man's mind that his eyesight suddenly failed him. There was nothing wrong with his eyes, because he reported himself cured, eighteen months later, after a happy marriage with his nurse. Likewise, psychiatrists, the specialists who deal with mental disorders, meet people with physically perfect ears who cannot hear, and people with sound and healthy muscles who cannot walk. It is as though the brain

Medical Miracle Men

Cure the Body Through the Mind

were a telephone "central" and one or another circuit, linking the mind with some part of the body, should break down. Then the affected part is "out of order" until repairs have been made.

Not long ago, for example, physicians prepared to operate upon a man who was so badly crippled that he could not bend his arms. Apparently he was suffering from arthritis, an inflammation of the joints. He was placed upon the operating table, and ether was administered to him. As soon as he was

unconscious, the doctors found to their amazement that his joints were perfectly limber! Then they knew that the case was one for the psychiatrist and not for the surgeon.

Cures for ailments such as these rank among the strangest and most unorthodox in medicine. Each case is an individual problem to tax a psychiatrist's ingenuity. Sometimes a simple artifice will break the spell that makes the patient's body the slave of his mental ills. Not infrequently, doctors and nurses must become actors in a drama prepared especially for the patient's benefit, with a "stage setting" arranged and dialogue rehearsed as carefully as for a Hollywood production.

All that it took to cure one patient was a sleight-of-hand trick. A middleaged woman decided that she had swallowed a fishbone and was choking to death. For a week she gagged and turned blue in the face. A throat specialist who examined her and found nothing in her throat was promptly dismissed. Then I was called. I realized that the hysterical woman's symptoms were imaginary, but her condition was serious. A fishbone simply had to be removed! "Palming" one like a magician, I slipped my fingers into the back of her throat. Then, with a sudden yank, I pulled out my hand and held the fishbone before her excited eyes. "I knew it!" she exclaimed triumphantly, and her husband was properly sympathetic. The gagging stopped at once. I eased my conscience, several weeks later, by letting the husband in on the secret.

Some sudden jolt, some overpowering emotion, will often achieve a cure in this strange realm of medicine. In fires and disasters, patients who have thought themselves paralyzed have run for their lives. I have heard of a case in which a victim of "mind-induced" paralysis was wheeled to an ocean beach and left there, as though by accident while the tide rolled in. When the water reached her chair, she fied in terror, not realizing that she had used her legs until she had reached the safety of higher ground. It may have been a harrowing cure, but it worked.

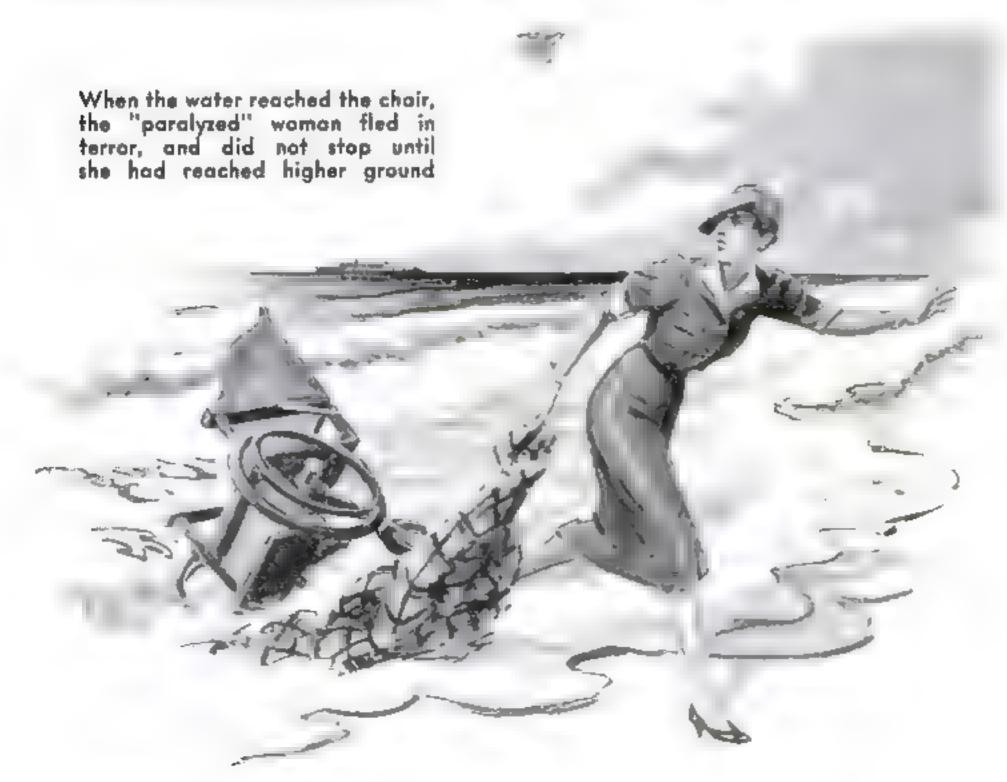
Dr. Abraham Myerson, of Boston, Mass., one of the country's leading specialists, used another method to cure a football player with paralyzed legs. Downed by a vicious tackle, the athlete had lain in bed for weeks with an injured spine—his legs numb and useless. All traces of injury had healed, but his legs were still paralyzed, when he was helped into the specialist's office.

A careful examination showed that his leg muscles were in perfect condition. Nothing prevented him from using them but a mental quirk, brought on by his accident. He would walk out of the office that very day, Dr. Myerson assured him. Attaching electrodes to the player's legs, the specialist shot an electric current through them. The muscles contracted violently, as normal muscles do, and the legs kicked forward. After a dozen trials, the patient was told to try

to help the electricity contract the muscles. As he complied, Dr. Myerson secretly switched off the current. The player's legs continued to kick rhyth-

BY REMOVING THE MENTAL
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SIGHT TO THE BLIND, AND
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By
FREDERIC DAMRAU
M. D.





mically. Suddenly, he realized that he was moving them himself. He stood up and walked, completely cured.

Anesthetics sometimes are used to "disconnect" the body temporarily from the mind, in treating cases of this sort. One of the strangest cures by this method that I know of occurred in Boston under the same specialist's direction.

A well-known university professor began to have trouble swallowing. Several throat experts examined him and found nothing amiss. By the time he came to Dr. Myerson's office, however, he could take liquids only with difficulty and could not swallow solid food at all. Two treatments cured him. In the first, he was told that he would be given a mild anesthetic, and would be able to drink liquids without the least difficulty when he awoke. Nitrous oxide, the gas used in dentist's offices, was administered. Just as he was on the point of recovering consciousness, a glass of milk was held to his lips and he was ordered sharply to drink. He awoke drinking milk freely, and could swallow liquids naturally thereafter. Three days later, the experiment was repeated. This time he was told that he would be able to eat solid food upon awakening. He recovered consciousness with part of a sandwich eaten, and his trouble entirely gone. The case ended with the doctor, his assistant, and the patient marching out together to a restaurant and ordering a hearty meal for all!

One of the most dramatic cures of my experience took place during the World War in the Army hospital at Fox Hills, N. Y., where I was stationed at the time. The patient was a soldier who had suddenly gone stone-deaf after two days in a dugout under constant and terrific bombardment. Examining him and listening to his story, we were convinced that his hearing organs were still sound. We believed his mind had made him deaf so that he would no longer hear the explosions of the shells, and we determined to try mental healing. We wrote him a message, informing him that we were going to cure his deafness with electricity. What we didn't tell him was that electricity could not cure him -or anything else but faith that (Continued on page 125)



Transplanted trees at the site of the 1939 New York World's Fair. A new arrival is being eased off the special truck that brought it, into the place assigned it in the plans

Man-Made Forest FOR A WORLD'S FAIR

N WHAT is called the greatest transplanting operation ever undertaken, thousands of full-grown trees from all parts of the United States are being moved on trucks, railroad flat cars, and seagoing barges to beautify the site of the World's Fair scheduled to open in New York City in 1939.

Following detailed charts and specifications drawn up by fair officials, tree scouts are combing the country as far west as the State of Washington for perfect specimens. Trees weighing twenty-five tons and standing sixty feet high are carefully dug up and shipped on special tree trucks, their roots protected in huge nine-foot clumps of earth wrapped in burlap. Transportation routes are carefully checked beforehand to insure the safe passage

of trees through underpasses and narrow streets. To avoid traffic, the trucks move into New York at dawn.

At the fair site, powerful winches lower the trees into waiting excavations, while workmen attach steadying guy wires and dig saucerlike depressions around the trunks to hold reservoirs of water. Among the forest of 10,000 trees that will be transplanted by the end of 1938 are specimens of oak, elm, sycamore, Norway maple, dogwood, and various evergreens.



Lowered into a waiting pit like a flower being potted, this specimen is ready to

have the burlap cover removed from the

Electric "Ear" Spots Sour Notes

PLUGGED into any light socket, a new pitch-testing device helps singers train their voices and enables musicians of broadcasting studios to tune their instruments "by eye." First sounding any musical tone called for, the outfit then "listens" to a note sung or played back into it and offers visible evidence if the note is sharp or flat, by means of "sound pictures" of wavy luminous lines produced by a cathode-ray oscillograph.



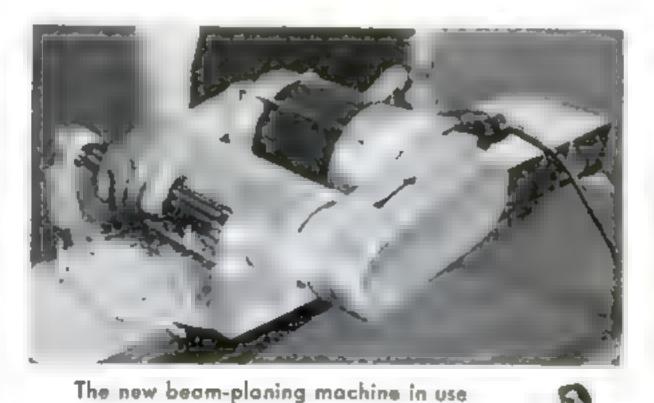


Cyclist Dives Through Flaming House

RACING up a ramp and hurtling at high speed through a flaming building, a dare-devil motor cyclist was caught by the camera in the unusual photographic shot reproduced above. The thrilling feat was performed at a race track near Chingford, England.

Portable Machine Planes Beams

FOR PLANING heavy beams, a portable tool operated directly from the usual lighting current has been developed in Germany. The planing depth may be adjusted easily while the machine is in operation, and the shavings are freely ejected so that they cannot hinder the free movement of the operator. The device is expected to save much heavy labor.



operated master

tuning forks that

emit tones for com-

parison of pitch

New Liquid Governs Sex of Babies

A LIQUID that is said to govern the sex of babies has been perfected by English research workers. The compound, which enables women to have either a boy or a girl as they desire, is reported to have been over eighty percent effective in actual tests on over 100 mothers.

Novel Truck Follows Bicycle Racers
To Broadcast News by Radio

EQUIPPED with powerful shortwave radio apparatus, a novel truck followed contestants in a recent long-distance bicycle race held in France, to enable a complete de-

scription of the event to be broadcast throughout the country. A glass-lined cupola, placed on top of the vehicle just back of the driving cab, served as an observation tower for the announcer who described the details of the race. Transmitting equipment in the truck relayed the program to a regular broadcasting station.

ews by Radio

A radio announcer reporting the progress of a race from the cupola of the odd truck ent in de-

SEPTEMBER, 1937



Portable Beach Tent Folds Like Auto Top

RESEMBLING a collapsible automobile top, a new type of portable beach tent can be folded into a compact bundle for carrying. Fitted with U-shaped ribs that provide rigidity to the waterproof

canvas covering, the miniature cabana need only be pulled open and placed on the sand. An extension canopy, supported by three short poles, provides additional shade.

Small Welding Machine Can Be Moved To Job

DESIGNED for use in automobile body factories, a new portable spot-welding machine allows hard-to-get-at welding jobs to be completed easily and quickly. Swung from the ceiling on a trolley, the welder can be moved directly to the spot where work is to be done.



Using the portable welder on a truck body

Penguin Is Radio Actor

As a novelty feature in a recent radio broadcast from Catalina Island, the sounds uttered by various rare animals were sent out over the air. In the photograph above, Oscar, a tropical penguin is seen making his radio debut.



Invalid Has Complete Bedside Office

A handy extension arm supports Dr. Rowlingson's telephone

USING ingenious mechanical aids of his own invention, Dr. C. B. Rowlingson of Los Angeles, Calif., for the past seventeen years has carried on his work as secretary of a medical society from his bed. Unable to walk, Dr. Rowlingson has a complete office at his bedside. In the photograph can be seen his telephone, mounted on an extension arm so that he can use it while flat on his back. A switch panel controls the various devices individually.

As car passes first officer, he radios report to second stationed down the highway

Police Employ Novel Speed Trap

MINIATURE two-way radio stations aid Kansas City, Mo., police in checking the speed of automobiles traveling the main boulevards and highways. Working in pairs and equipped with combination short-wave transmitting and receiving sets, two officers conceal themselves along the roadside 770 feet apart. As a speeding car passes, the first officer reports by radio to the second, who immediately starts a stop watch. If it shows that the motorist took less than fourteen seconds to traverse the 770 feet, a motor-cycle rider is sent after the speeder.





Checking speed with a stop watch, second officer dispatches motor-cycle rider

This "water sledge" covered a 320-mile course at an average speed above sixty miles an hour

Odd Two-Hulled Craft Wins World's Longest Motor-Boat Race

ENTERED in the longest motor-boat race in the world, a 320-mile speed run between Pavia and Venice, Italy, a strange catamaran-type craft called a "water sledge" roared over the water at an average pace of more than sixty miles an hour to win the contest. An air propeller drives the novel speed-boat, which resembles a seaplane without wings and skims the water under the control of a driver in a cockpit at the extreme stern.

New Garden Tool Removes Rose Thorns

AMATEUR gardeners and purchasers of cut flowers are spared pricked fingers by a new tool that separates roses from their thorns. When the device is placed over the stem as shown in the illustration at right, and drawn sharply downward, two circular blades shear off the prickles. According to the maker, it is impossible to cut or bruise the stem of the flower.



Light "Plug" Protects Worker in Steel Press

A NEW "plug" of lightweight magnesium alloy, inserted between the jaws of a mighty steel press, protects a repair man against the danger of the machine being started accidentally while he is inside. Plugs formerly used for this purpose were so heavy and hard to handle that the safety precaution often was not observed, but the new type removes the temptation to take a chance.

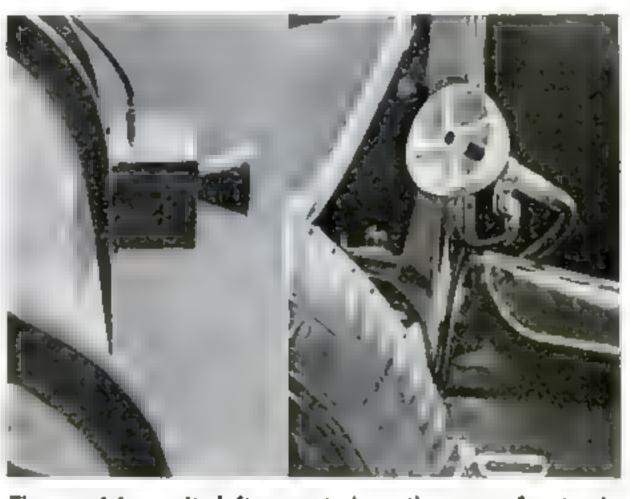


A worker repairing a steel press. The lightweight "plug" guards him against accident

"Silent Horn" for Traffic Reduces Noise

SUGGESTING a way to abolish the nerve-racking honking of street traffic, a "silent horn" for automobiles, produced by a German inventor, emits a tone too high-pitched for the human ear to hear. On another car, a microphone picks up the inaudible sound and a gentle, melodious hum is heard from a loud-

speaker beside the driver's ear. If all cars were equipped with this signaling and receiving apparatus, the inventor points out, an ordinary horn would be sounded only to warn pedestrians. His idea has already been tested experi-



A microphone picks up inaudible sounds

and a buzzer hums in the driver's cab

The receiving unit, left, mounted on the rear of a truck, and the tiny horn that emits the high-pitched warning tone

mentally on motor trucks, for which it presents a particular advantage, since a truck driver often cannot hear the honking of a car right behind him because it is drowned out by the noise of his own machine.

Boy Railroaders



Nose of the realistic midget streamliner constructed by two California youths as crack train of the "Frazier Park Railway"

ITH salvaged junk for materials, a crude shed for a roundhouse, and a valley near their homes for a right-of-way, two California boys have built themselves a railroad. After two and a half years' work they are putting the finishing touches on a seven-ton, fortyfoot-long streamline train a gasoline-powered locomotive and two coaches accommodating twenty passengers—and half a mile of track upon which it will run.

The remarkable enterprise was conceived when sixteen-year-old Bud Fife, of Frazier Park, and Walt Osborn, of Bakersfield, exploring Frazier Mountain, discovered an abandoned borax mine and a treasure trove of rusting dump-truck wheels, corroded boiler plate, and halfburied rails, which they readily obtained

permission to salvage. From perilous

crumbling tunnels, where a cave-in once imprisoned Walt for an hour until Bud dug him out, the pair dragged home the material. With the

> aid of the Bakersfield High School machine shop, their streamline train took shape.

> They mounted

the boiler plate. An automobile-truck chassis made a frame for each car, and galvanized corrugated iron provided the sheathing. In the

joint to four drive wheels linked by endless—chains. They designed their own air-brake system, with a compres-86r operated from the motor's fan belt. The coaches have restaurant-type chairs

and a six-volt lighting system.

locomotive they installed a four-cyl-

inder automobile motor, connected

through a drive shaft and a universal



the ten-inch, mining-car wheels on trucks laboriously hacksawed from

The observation coach receiving finishing touches MINE EQUIPMENT

FINDS ODD USE

In this crude back-

yard shop, rails and

other materials sal-

vaged from old mine

workings were turned

into track and rolling stock by Bud Fife and

Walt Osborn, seen at

the left. The boys have

spent nearly three

years at the work. The

picture below shows

Fife at the controls of

the train, which is driv-

en by a gosoline engine

This mask protects the ears as well as lungs and eyes How the mask is pulled in place over the head like an ordinary bathing cap

Gas Mask Is Made Like Bathing Cap

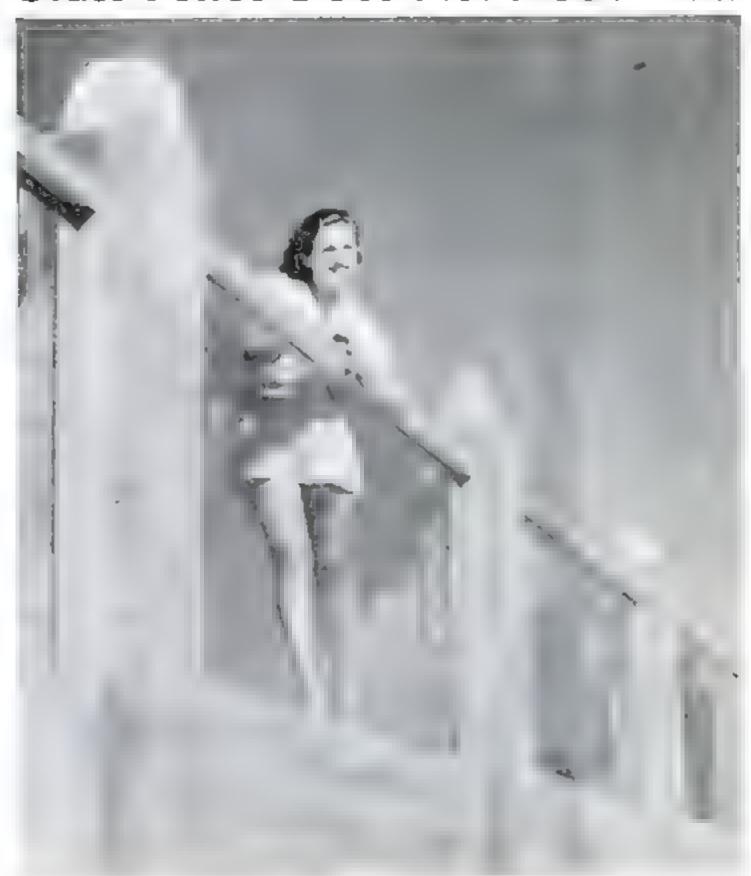
SLIPPED over the head like a bathing cap, a new gas mask now being manufactured for use by German civilians is said to be impervious to all known war gases. The close-fitting head cover protects delicate ear membranes against the corrosive action of a recently developed "ear" gas.



SET into the side of a bathtub, a watertight door makes it easy to get in or out without danger of slipping. Hinged at the bottom, the door serves as a ramp when open. The device is intended especially for the use of invalids and elderly persons, who find it difficult to step over the edge. The tub is pictured in use at the left.

A door in the bathtub drops down and forms an exit ramp

Glass Fence Does Not Block View



GLEAMING panels of plate glass set between concrete posts form a unique fence around the grounds of a home in San Diego, Calif. The transparent fence is said to keep out intruders without interfering with the view.

Tiny Rubber Pellets Clean Glassware

PROPELLED by high-pressure water jets released when the glass is pressed down, tiny rubber balls scrub the inner surfaces of glassware in a new cleaning device offered for use in restaurants and soda fountains. The rubber pellets are charged with emery, the same material used to polish glass in manufacture. Self-cleaning, they are said to remove food residue quickly.



New Streamline Locomotive Resembles Giant Bug

RESEMBLING a huge grasshopper even to earlike side shields, a streamline steam locomotive recently exhibited in Paris, France, is said to attain a speed of more than ninety miles an hour. Shown at the Saint-Lazare station, the locomotive is scientifically sheathed to reduce air resistance without making working parts inaccessible. It hauls a train of specially built, lightweight, streamline cars.

Planes Generate Own Static

INTERFERENCE with plane-ground radio communication often is due to static generated by the airplane itself, recent tests with a "flying laboratory" show. Previously, such interference was blamed on electrical charges in the clouds, but engineers now find that discharges from the trailing edges of the wings cause the trouble. Experiments are under way to find means of discharging the self-generated static.



The streamline sheathing on this locomotive is arranged so working parts are accessible



Rubber-tired dollies like this carry the delicate cameras to and from the planes

From Miles Above the Earth, Giant Snapping Photographs That

of the Whole Expanse of

NCLE SAM is, posing for a \$30,000,000 portrait. Cameras in the sky are now busy snapping 2,500,000 pictures which will be fitted together by Government experts into a vast aerial map of the United States. When it is completed, some years hence, it will show every village, every farmhouse, every tree, in more than 3,000,-000 square miles of territory.

This gigantic project is being carried out under the direction of three Government agencies, the Soil Conservation Service, the Forest Service, and the Agricultural Adjustment Administration. In addition to showing the location of roads and streams, the finished map will indicate the elevation of hills and valleys and will record even the type of soil in the fields of different sections.

No other photographic project in history has approached the magnitude and cost of the present plan. Field crews will gather data on soils and elevations while the flying photographers are snapping their thousands of pictures from the air. Planes will fly, for most of the work, at a uniform altitude of 14,000 feet. Each time the shutter clicks, the photograph will record about one and a half square miles and will cost the Government approximately \$6.35.

Already, high-flying planes are droning over the "dust bowl" of the Southwest, mapping nearly 80,000 square miles of Kansas, Oklahoma, Texas and Colorado, as one of the initial steps in the program. Sections of the country where soil erosion and flood conditions are worst will be photographed first.

Two innovations in aerial photography which have been announced recently may play an important part in the work.

The first is a \$10,000 darkroom on wheels. It is a 21/2-ton truck equipped with running water, electricity, a refrigerating unit, developing tanks, drying reels, contact printers, and an enlarging camera. No matter where the base of operations is located, this mobile laboratory permits films exposed during the day to be processed and printed during the evening and night. Mistakes in piloting or the jamming of a camera are thus discovered at once, and the pictures can be retaken before the camp is moved.

The second innovation is more spectacular. Imagine shooting off 1,000,000 photoflash bulbs in one burst of light! That, in

FOR HIS PICTURE

Aerial Cameras Now Are
Will Form a Huge Map
the United States

effect, is what is done in a new system which permits aerial surveys to be made during the hours of darkness. By an ingenious combination of photoelectric cells, automatic cameras and flash-light bombs, survey snapshots can be made of the ground at night which compare favorably with those taken by daylight.

The operator merely presses a button when his plane is over the spot to be photographed. This releases the bomb. A parachute opens and its initial pull on the bomb ignites a fuse which sets off the intense light. This, in turn, generates minute electric currents in a magic "eye" on the bottom of the plane, and these currents are amplified to snap the camera shutter at the precise moment when the light intensity is at its peak. Drifting downward under its parachute, the light bomb is out of the camera's field of view. Because the whole operation, except for pushing a single button, is automatic, the pilot of the plane can take pictures, thus making the innovation particularly valuable for military " observation work.

In mapping America's 3,000,000 and more square miles, aerial photographers will use cameras costing from \$4,000 to \$13,000 apiece. Mounted on shockproof cushions of sponge rubber, the precision instruments automatically snap pictures at intervals of from six to seventy-five seconds. The exposures range from 1/50 to 1/100 second. Film for the big cameras comes in seventy-five-foot rolls. Each will record 100 pictures measuring nine by seven inches.

The latest in aerial cameras, a giant with ten lenses, photographs 600 square miles in a single snapshot. Month after month, one of these outfits has been taking the same picture, Boulder Dam and the lake filling up behind it. Every time the lake rises twenty feet, an airplane soars aloft and a photographer takes another picture. This will continue until the water flows over the top of the dam. The purpose of this procedure is to create a natural contour map of the lake basin. As the water rises, the shore (Continued on page 129)



This huge photographic map of Connecticut, made for the State Highway Department, was one of the largest jobs of the kind ever attempted before the present nation-wide plan

Cameraman Wears Wartime Garb

TO PROTECT himself while filming riots, fights, strike disorders, police battles, and other news events dangerous to spectators and bystanders, Irving Smith, newsreel cameraman, reports for duty in the outfit shown in the photograph at the left. In addition to a gas mask that permits him to use his camera in the face of a tear-gas barrage, Smith takes the added precaution of wearing a bullet-proof vest and a steel helmet to

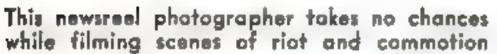
guard against stray shots and flying missiles that might come his way.



Airplane Instrument Shows How Weight Is Balanced

DIALS on a new visual-indicator instrument developed for use in commercial airplanes show how the ship is balanced in flight. By adjusting various control knobs on the panel of the device, the pilot is able to tell whether the weight of fuel, ballast, passengers, cargo, and mail is well distributed to insure efficient operation of the plane in flight, or whether the ship is nose-or tail-heavy.





Dressing Table Has Dual Looking-Glass

MIRRORS mounted on a revolving circular disk form the outstanding feature of a new dressing table for women. Placed at the back of the table, the disk is divided into two segments, one covered by a plain mirror for regular use, and the other by a "night mirror" which is tinted to show how make-up will appear under artificial light. Thus evening make-up can be put on before sundown.

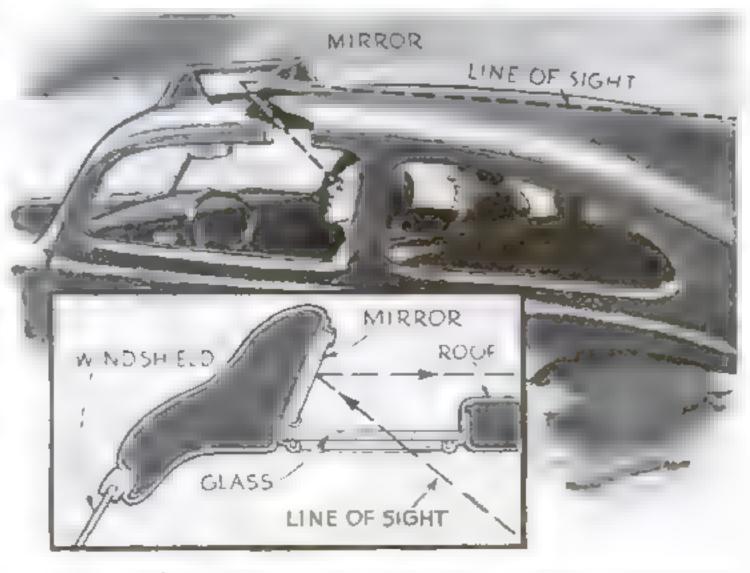
Table Tennis Is Played in Swimming Pool

TABLE TENNIS played in a swimming pool is a novel sport recently introduced by enthusiasts in Philadelphia, Pa. With its legs removed, the playing table is attached to inflated rubber floats that hold it about a foot above the water in

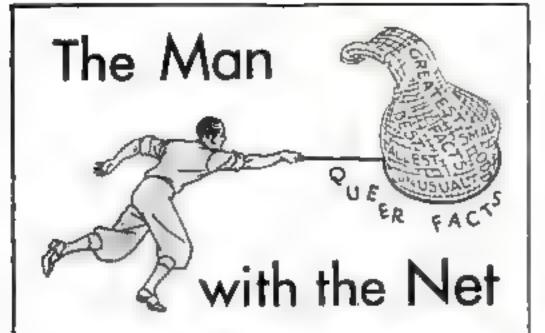
the shallow end of the pool. Clad in bathing suits, the players stand waistdeep in the water, which, by resisting their normal movements, is said to add new zest and enjoyment to the popular game in warm weather.

New Rear-View Mirror Is Set into Car Roof

HOUSED in a streamlined unit on a car roof just above the windshield, a new-style rear-view mirror gives automobile driver a clear, unimpaired view of the road behind him. The glass is visible through an adjustable window in the roof, which can be opened to serve as an auxiliary ventilator.

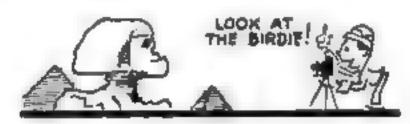


How the auxiliary mirror is mounted above a window in the car top



ILLINOIS is more densely populated than China.

TWO THOUSAND times a day, it is estimated, tourists photograph the Sphinx in Egypt. On Sundays, the snapshots mount to about 5,000.



IRONING a bed sheet continually from side to side increases its width and decreases its length.

THE VIKINGS fashioned swords from meteoric from

COAL burned in the United States each day does more mechanical work than all men in the country do in a year.

DENTAL FILLINGS in the United States require \$25,000,000 worth of gold annually, as well as about \$5,000,000 worth of silver and platinum.



SCIENTISTS in the United States have been increasing in numbers at a much higher rate than the general population.

PANAMA-CANAL locks are too small to admit either the Queen Mary or the Normandie.

RABBIT SKINS are being tried as a source of glue in Belgium.

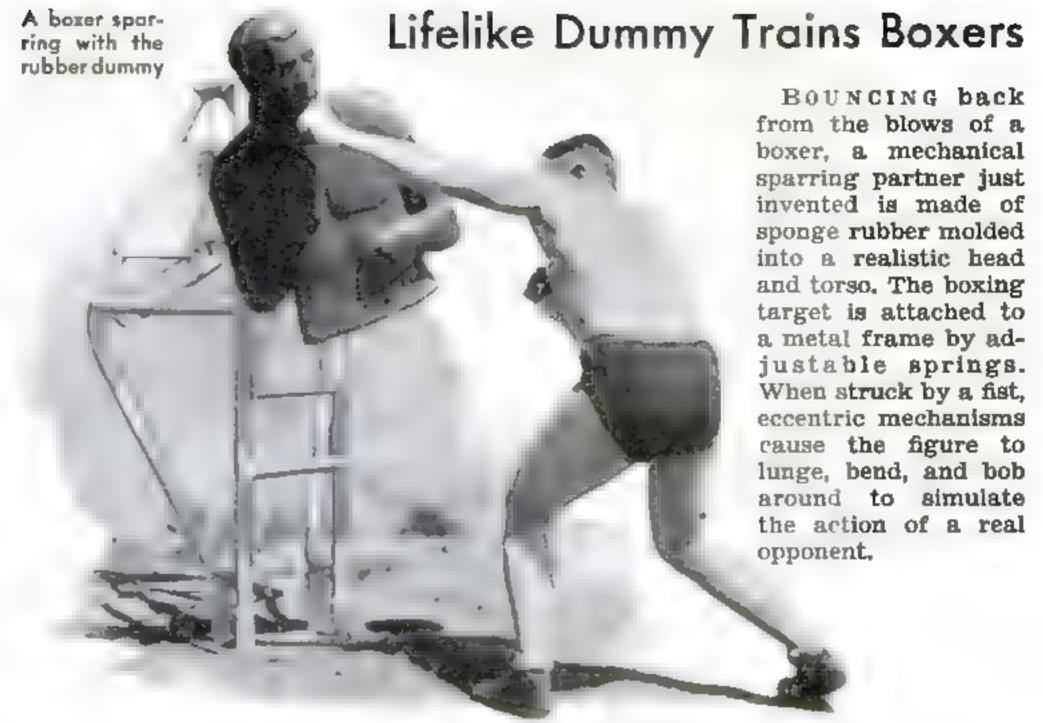


DEEP SOIL shrinks in dry weather, expands in wet.

DANCES of New Guinea natives were copied from birds.

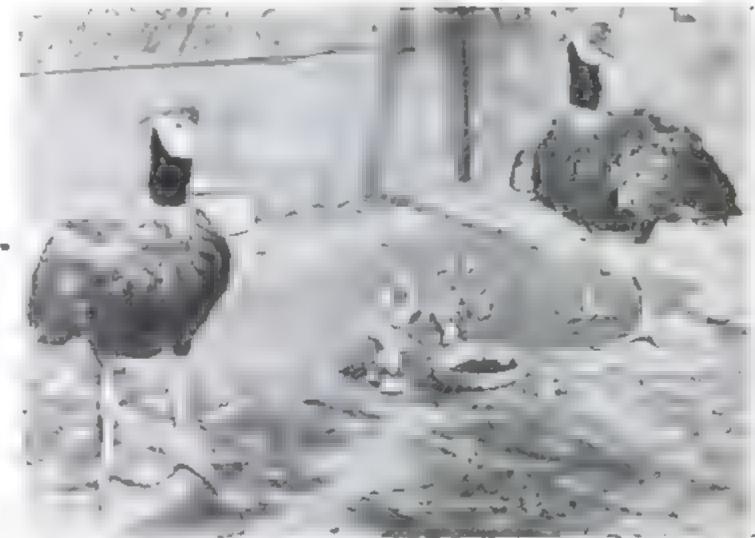
RICE that pops like pop corn is a new agricultural product.





Rare Birds Hatch Quintuplets in Captivity

ALTHOUGH they seldom breed in captivity, two rare South American birds recently surprised officials of a Los Angeles, Calif., zoo by hatching out the five young ones shown at the right. Known as crested screamers, the birds make a noise loud enough to be heard for several miles. The parent screamers took turns sitting on the eggs during the fifty-day period needed for hatching.



These rare birds required fifty days to hatch the five young ones

Camera Fan Is Walking Studio

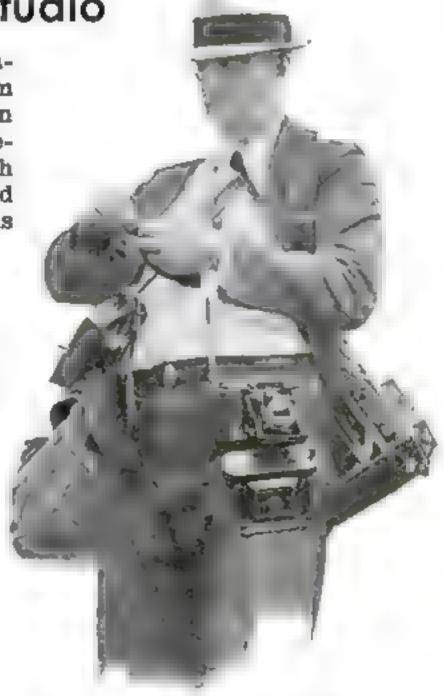
LOADED down with almost \$1,000 worth of cameras and photographic accessories, F. A. Morgan took the prize as the most enthusiastic camera fan when a New England railroad recently ran a special train to provide amateur photographers with the opportunity of snapping authentic railroad scenes. Morgan is pictured at the right reading his exposure meter.

Steam Pad Replaces Face Towel



Flaps in the pad keep fingers from slipping

A NOVEL steam pad has been designed by a California inventor as an improvement over the conventional hot towel used on the face after shaving. Made of a double layer of toweling material, the pad has an oval aperture that leaves the mouth uncovered. Finger flaps are provided at either end for holding the pad against the cheeks in the manner illustrated in the drawing at left.

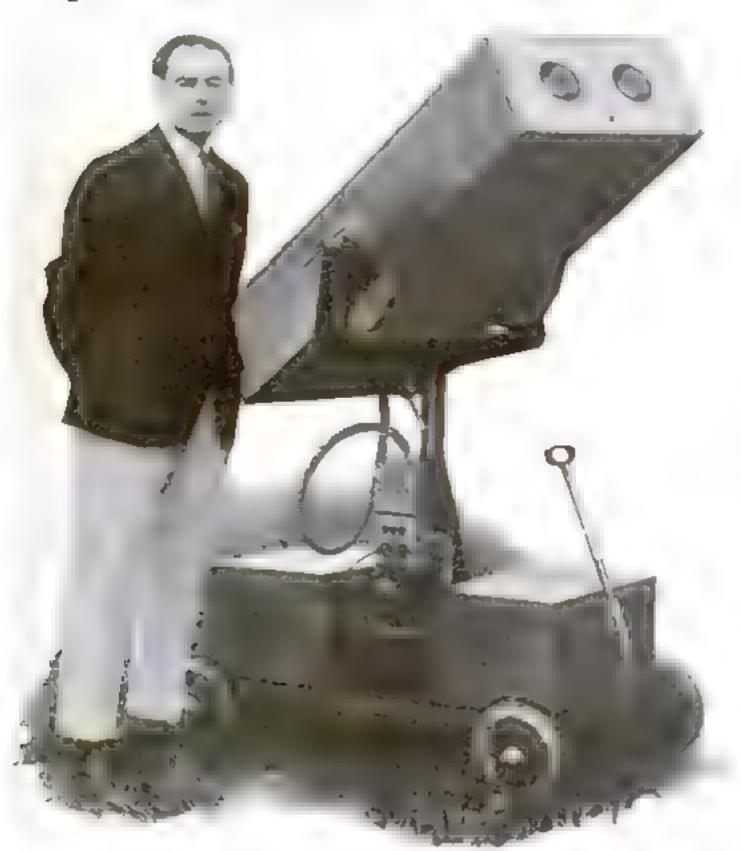


F. A. Morgan, amateur photographer, equipped for picture-taking



Planes Paint Huge Flower in the Sky

TRAILING dense clouds of smoke, Royal Air Force planes traced artistic patterns in the sky at a recent air display at Hendon, England. In the photograph above, the fighting craft are painting a huge aspidistra flower against a background of clouds in a rehearsal for the event.



The special mounting permits scanning of any part of the sky

New Coin Wrapper Aids Bank Clerks

WRAPPING coins is made easier for bank employees by the use of a special device invented by a Chicago man. As fast as coins can be raked off the counter into the funnel of the contrivance, they are arranged neatly in cylindrical wrappers. A springactuated sleeve slides along the roll to force the pieces of money into orderly arrangement and pack the cylinders tightly.



How the wrapper is used to make neat bundles of coins

Electric Map Shows Toy-Train Routes

Toy railroad trains are operated on "transcontinental" schedules by an ingenious electric map device just introduced. Connected to the miniature-railroad circuit, the United States map indicates by dots of light the imaginary progress of a train across the country. The apparatus is automatic but can be controlled manually if desired.



Moving lights on the map trace the route of "transcontinental runs"

"Magic Eye" **Detects Planes** in Air Attack

DETECTING the approach of distant airplanes, a magic-eye apparatus recently developed by Prof. Alan Fitzgerald of Swarthmore College, Swarthmore, Pa., is expected to be of great value as a defensive device for wartime use. Mounted on a rolling carriage, the instrument is pointed skyward in the direction from which an attack is expected. Long before oncoming planes can be seen or heard, the magic eye automatically sounds an alarm, thus eliminating the possibility of a surprise attack and enabling a defensive fleet to take off in plenty of time to meet the enemy air force.



Special Telephone Stand Leaves Both Hands Free

AN ADJUSTABLE telephone device just invented leaves the user's hands free while making a call. Metal arms extending from a central column hold a transmitter in front of the mouth and a receiver at ear level. The apparatus is designed for order clerks and other persons who write while they 'phone.



Compare the size of the tiny padlocks with that of the pin in this picture

How the World Looks to ANIMALS

LIGHTS

MODEL
OF SCENE
AS IT
APPEARS
TO
ANIMAL

Displays like this show what animals see. Right, the phonograph mechanism that controls the display and delivers the lecture

I OOKING at the world through the eyes of hens, fish, dogs, and other animals is made possible by an ingenious series of exhibits recently installed at the American Museum of Natural History in New York City. As the visitor approaches one of the tall cabinets that house the displays, he interrupts a light beam, thereby actuating a photo-electric cell that switches on the operating mechanism. A conventional barnyard scene appears on a gauze screen stretched across a window in the cabinet. Then, as illumination on the screen dims, lights within the cabinet build up to full brilliance to reveal through the gauze a three-dimensional model of the barnyard in the proportions in which a hen would see it. A recorded lecture coming from the cabinet's built-in loudspeaker explains that the hen views the rooster as a giant not only because of his larger size but also because he is the dominant personage of the barnyard. Also, the lecture says, a hen severely pecked and "overawed" by another sees her companion as much larger than herself, even though both birds are exactly the same size.

Moving on to another cabinet, the museum visitor watches a dining room, pictured in bright colors, change its perspective and fade to a drab gray to represent the scene as viewed by a short-legged bulldog. "Dogs are color-blind and lack the human's ability to judge

lines and angles," the loudspeaker lecture points out. Two pictures in the next display demonstrate how the eye of a common fly sees a barn as a curious mosaic of spots that resembles a half-tone engraving of a photograph as seen through a microscope. The compound eye of the fly, it is explained, breaks up any scene viewed by the insect into countless individual spots.

Perhaps the most astonishing exhibit in the entire group shows the visitor how he looks to a fish when he casts a trout fly into a mountain stream. The gauze screen, picturing an angler knee-deep in the water, becomes transparent under the changing lights, revealing how a trout envisions the scene from under the water. Reflection and refraction of light rays, together with the natural short-sightedness of the fish, shortens the angler's legs, stunts his body, and swerves his head to the right.



L.FE-S.ZE

ANIMAL

MODEL OF



A HEN'S-EYE VIEW OF THE BARNYARD. The picture at the left, above, shows how the scene looks to a human eye. At right, the way it appears to the hen in the foreground. The other fawls look large or small, depending on whether or not the hen is afraid of them

SOUND

A COMMON HOUSE FLY, looking at a group of farm outbuildings, sees

Ingenious Displays in a Museum Enable Human Beings to View Common Scenes Through the Eyes of Dogs, Hens, and Fish

A COMMON HOUSE FLY, looking at a group of farm outbuildings, sees a curious mosaic of images through the many units of his compound eye. Any scene the fly views is similarly broken up into a pattern of tiny spots

DOGS are color-blind, and connot judge lines and angles as humans do. This room, as seen by the canine eye, appears flot and colorless





WHAT THE FISH SEES of the angler is illustrated by this odd display. Reflection and refraction of light distort the image strangely

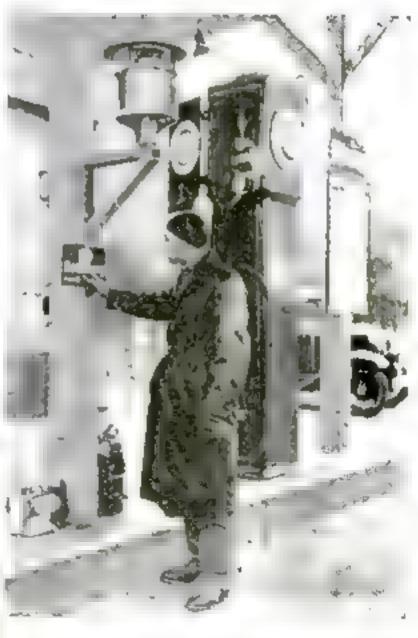
Car's Headlights Turn on Lamps at Filling Station

EADLIGHTS of approaching cars automatically turn on the flood lamps of a filling station equipped with an "electric-eye" apparatus designed for nighttime use on German highways.

As a car turns off the highway and heads into the roadside station for gas or oil, its headlight beams strike the photo-electric unit mounted between the fuel pumps as shown in the photograph. This activates a sensitive relay mechanism that throws the switch of the station's lighting system, thus advis-

An "electric eye" mounted between the pumps picks up light from the lamps of a car when it approaches ing attendants of the car's approach. Another advantage of the photo-electric unit is that it eliminates the necessity of keeping the filling station lighted late at night to indicate that it is open for business.





To summon an attendant, a motorist presses a button that rings a bell. The system is for isolated stations

The collapsible rubber surfboard in use and, at left, deflated. Overlapping wooden side pieces make it rigud

Trap Shooter Has Four Eyes

To sheeld their eyes from sun glare, trap shooters often wear eyeglasses with opaque lens tops. The enthusiast shown below has decorated his glasses with grotesque eyes which, combined with a derby hat, give him a comic appearance.

Folding Surfboard

CAPABLE of supporting two persons in the water when inflated, a new rubber surfboard can be folded into a compact unit for ease in carrying. The board weighs only nine pounds, and is braced at the sides with overlapping wooden strips. It can be inflated quickly with a bicycle pump.

Is Made of Rubber

Golfer Practices on Portable Green



When bad weather forces him indoors, Willie MacFarlane, a professional golfer, practices his short shots on a novel portable putting green. Made of mohair velvet backed with springy sponge rubber, the "green" is said to simulate the action of real grass. The artificial putting surface can be rolled up and carried about conveniently.

This artificial putting green rolls up into a compact bundle





Motor Drives New Cutting Torch

PIECES of any practical shape can be cut easily from thick sheet steel with a new motor-driven oxyacetylene cutting machine. For irregular patterns it is steered by hand, while circles of various diameters can be produced automatically by the use of radius rods and straight lines by guide wheels running on an adjustable track.

Cereal Plugs Joints in Road

WHEAT GRAINS, exploded by steam after the manner of a popular breakfast cereal, are now mixed with rubber to form a plastic filler for the joints between slabs in concrete roads.



Pounded from a horseshoe, this crude blade began a knife maker's career

Custom-Built Knives

HUNTING KNIFE made from a horseshoe started Giles P. Wetherill, of Philadelphia, Pa., on a unique career as a designer of original, "tailor-made" knives for collectors, explorers, and sportsmen.

Some years ago, Wetherill was hunt-

ing antelope in the Black Rock Desert of western Nevada. As he was skinning one of the animals, his hunting knife snapped off at the handle. Riding eighteen miles to another ranch, where race horses were being trained for the Tia Juana track, in Mexico, he obtained a steel horseshoe and out of it hammered and sharpened a makeshift blade. It worked so well that he took up the hobby of making knives for his friends. In 1931, the hobby turned into a business. Wetherill organized a novel concern, the only one of its kind in America, to produce custom-built knives for sportsmen.

In the last half-dozen years, more than 115 new kinds of knives have come from the Wetherill workshop.



Giles P. Wetherill with some of the hundreds of knives he has created. He is shown holding the "phantom" throwing knife. It is made with a special slot in the center to balance it when it is thrown

ROBERT E. MARTIN

For cutting the tough, inch-thick hide of the rhinoceros, Wetherill designed this skinning tool for an explorer. Its blade is made of Swedish chrome steel

Adding the final polish to a ten-inch, dagger-shaped knife designed for killing sharks

They range from modernistic carving sets, produced at the request of an architect, to a machete with a saw on the back of its blade, devised for an explorer to use in hacking his way through Central American jungles. Although some of Wetherill's original creations cost as much as an automobile, orders come in from as far away as South America, Mexico, England, and Africa.

Last March, he completed the most ornate knife so far ordered, for one of the owners of the Kimberley diamond mines in South Africa. The handle of the nine-inch knife was adorned with thirty-seven and a half carats of semi-precious stones. The sheath was made of a layer of rhinoceros hide embellished with silver-wire filigree. The weight of the completed knife was fifteen ounces. It cost \$1,200—eighty dollars an ounce!

Probably the most unusual order Wetherill has received came the other day from England. The Duke of Lancaster commissioned him to make exact reproductions of the sword and dagger worn by his ancestor during the Wars of the Roses, the thirty-year struggle between the houses of Lancaster and York in the fifteenth century. Before work begins, weeks of

research will be necessary to get every detail correct.

Such "show pieces," however, are a small part of Wetherill's work. His main business is producing new knives of greater utility. In working out the designs, he tackles the problems involved as an engineer would approach a construction job. He calculates strengths and strains and forces. He carefully balances the knives for the work they are to do. He takes into consideration the points where strength is needed most, where the pressure will be exerted in different operations, and how slight variations in the shape and line and grinding of the blade will affect its cutting quality.

More than half a dozen different types of steel are used in the knives. To meet special requirements, Wetherill uses steel from England, Sweden, Finland, and Germany, as well as from the mills of the United States. The metal purchased for the knives comes in the form of strips. For use in the Wetherill shop, one American mill produces a special alloy. Customers wait from four to six weeks for the delivery of the handmade knives.

A couple of years ago, Dr. B. B. Gilmore, New York hunter and explorer, was leaving for the interior of Africa. He asked Wetherill if he could design a knife that would enable him to skin a rhinoceros. The hide of that animal is among the toughest known, and sometimes is an inch thick. The knife that



These stronge-looking implements are an architect's idea of a modernistic carving set

filled the bill had a scimitar-type blade of Swedish chrome steel more than seven inches long. The handle, of 100-year-old walnut, was designed to give maximum leverage. In cutting through the tough hide, the knife was rocked back and forth to increase the slicing effect of the blade. The inner side of the curving blade also was sharpened so it could be used as a sickle for hooking brush in the jungle.

Another double-threat knife was produced for an angler. It has a blade sharpened on one edge and provided with a series of teeth on the other for scaling fish. A slot in the tip can be slipped over the shank of a hook that is embedded in the mouth of a fish and the knife given a turn, with the

era tagit, sanganan kerting bili ber Jan

hook as the pivot, to cut the barb free. A second knife made for use in fishing, has a buoyant handle which keeps the knife affoat if it falls into the water.

Last summer, an excited angler rushed into Wetherill's office with the request for a knife that would kill a shark. He explained that he had been fishing alone in a boat off the New Jersey coast and had hooked a shark. which he had pulled into the boat with him. It had flopped about until, in terror, he had fired a bullet through its head. Unfortunately, the bullet went through the bottom of the boat and water began to pour in. Other sharks, attracted by the blood of the dead fish, began milling about the sinking boat. For two hours, the angler signaled for help and bailed out the water as best he could before another boat rescued him. He said he wanted Wetherill to design a knife which he could carry on salt-water expeditions to kill sharks and other large fish.

The result was a straight-bladed, 10½-inch knife patterned on the style of a dagger. A half-moon guard separates the blade from the handle. The latter is formed of seasoned walnut.

In making the handles for his knives, Wetherill employs about fifty different kinds of wood from many parts of the world. There is satinwood from Australia, mahogany from Africa, cocobolo from Panama. The customer is given his choice of woods. He also can select any one of (Continued on page 126)



Wetherill's novel knife sheath that holds both handle and blade. The knife stays in place even when the sheath is upside down

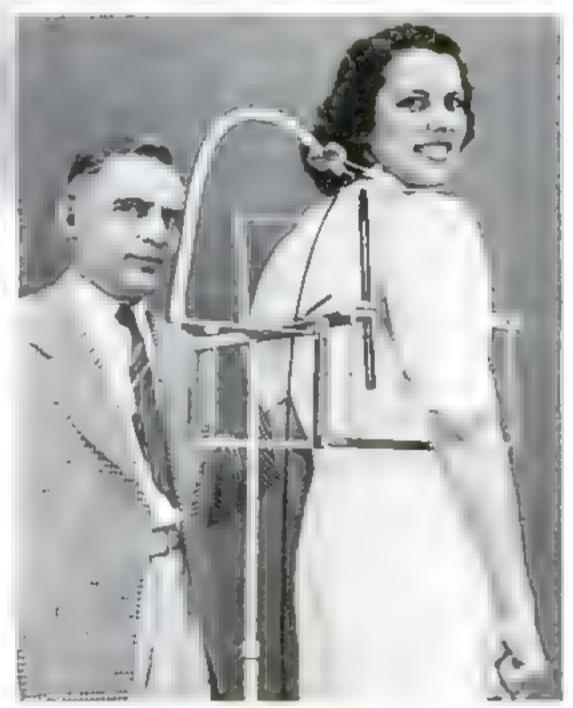
60



Motor Cycles Combat Mosquitoes

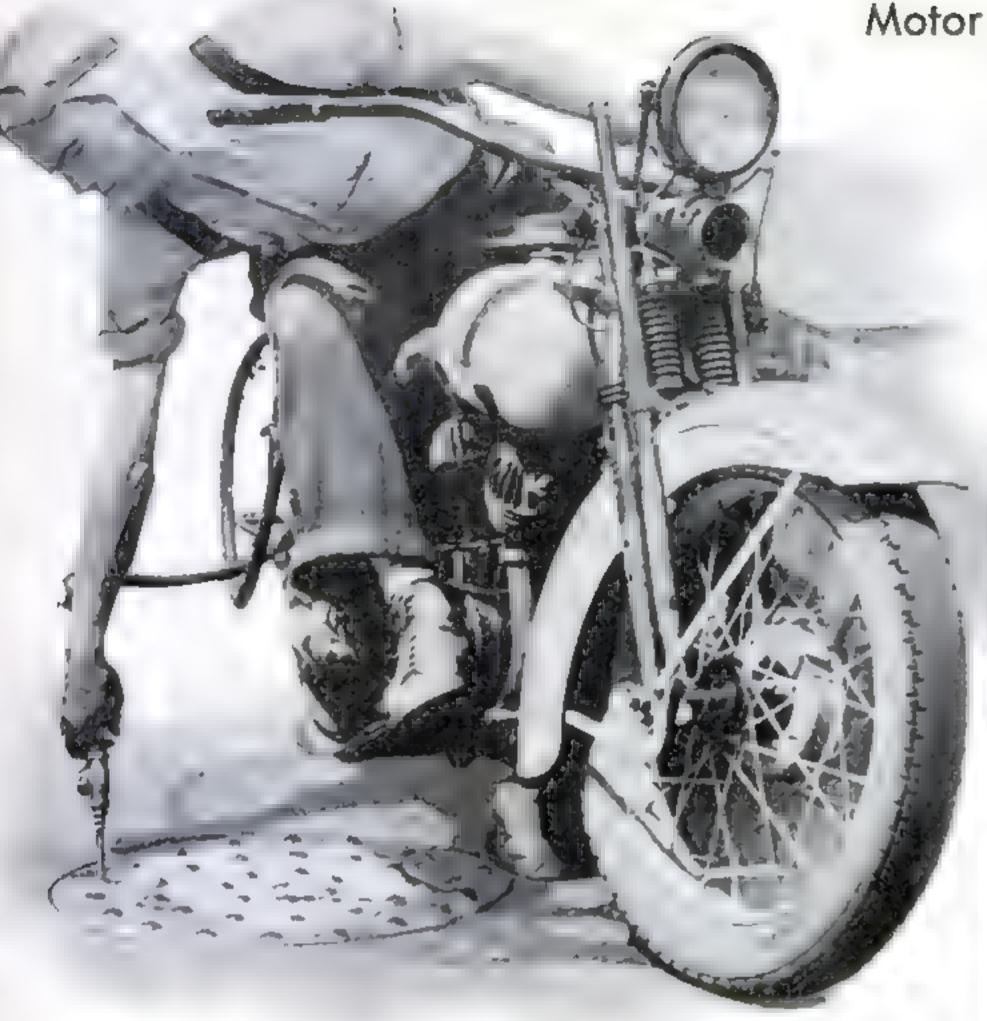
MOTOR-CYCLE riders are aiding towns of the Des Plames River valley, west of Chicago, to combat mosquitoes. Equipped with a portable sprayer, a single cyclist can make the rounds of 400 manholes a day. exterminating the mosquito "wrigglers" or larvae that breed in the stagnant puddles beneath the covers.

Odd "Mechanical Tailor" Measures for Clothing



Exact body measurements are made with this device

USTOMERS of dressmakers and tailors are guaranteed a good fit, it is said, by a new mechanical aid. Steel tapes attached to adjustable arms upon a metal standard quickly reveal neck, waist, and other needed measurements, and insure a good fit.



A member of the motor-cycle patrol spraying oil into a manhole to kill mosquita larvae

Portable Soda Fountain Serves Drinks on Street

INSTEAD of waiting for his customers to come to him, an enterprising vendor of Brussels, Belgium, strapped a portable soda fountain to his back and went out looking for new trade. The illustration above shows him serving a drink to a customer.

"Smoking" Two Cigarettes Cuts Down Nicotine

"SMOKING" two cigarettes at once, research workers find, is one way to eliminate nicotine. The second cigarette is not ignited, but is enclosed in a hollow holder to filter the smoke. It holds back fifty-four percent of the nicotine.

Find Sunken Submarine To guide rescuers to sunken submarines, and reveal the fate of ships and planes lost at sea, a French inventor proposes dyeing the ocean. Besides the marker buoys that submarines now re-

Dyed Spot in Ocean Helps

lease in case of accident, he suggests that ocean craft carry self-releasing packages containing fifteen to twenty pounds of a dye like fluorescein, which will give a yellowishgreen color to more than 20,000,000 times its weight of water. Visible to aircraft fifteen miles away, the spot should last twenty-four hours.



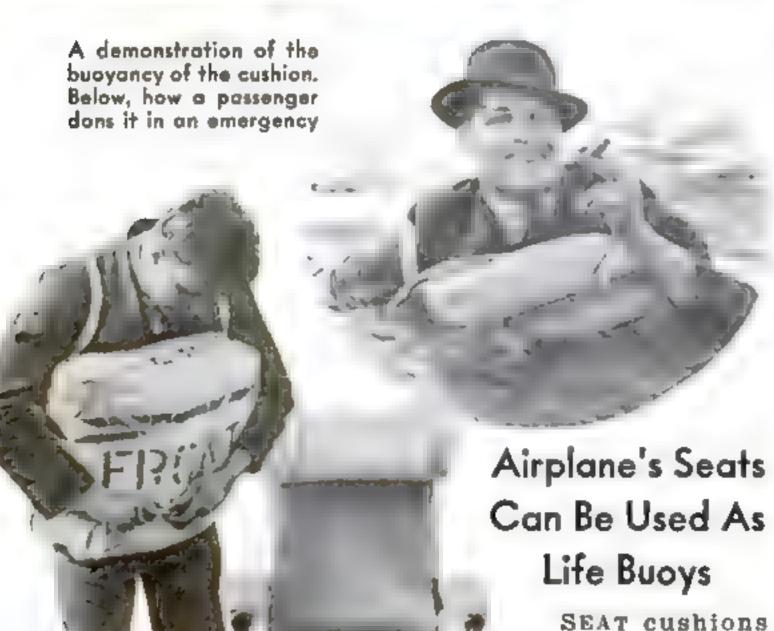
Twelve-Year-Old Pilot Sets Record with Solo Flight





SAID to be one of the youngest pilots ever to fly a full-size airplane alone, Edward Somers, twelve years old, recently made his first solo flight from Floyd Bennett Airport, New York City. After completing a short course of instructions, the

youthful aviator took an open-cockpit biplane, shown above, for a fifteen-minute flight, taking off and landing in perfect style. The boy airman comes from a "flying family;" his father was a wartime pilot, while his sister, sixteen, and brother, seventeen, both are flyers.



that can be converted into life preservers are a feature of airplanes to be used in a proposed transatlantic air service. The cushions, inflated with air, weigh only five pounds. They are worn as shown in the photographs at the left.

Giant Scraper Repairs Highway

LITERALLY planing off the surface of a macadam road, a giant scraper repairs roads in Germany without requiring new material. The novel machine slices off the top surface of the highway, including bumps, and uses this material to fill in any holes that are encountered. The device also is useful for leveling lawns, and for removing ice and snow.

Makes Ocean Trip in "Iron Lung"

His body encased in an "Iron lung", Frederick B. Snite, Jr. recently made a 10,000-mile trip from Peiping, China, to his home in Chicago, Ill. Ever since he was stricken with infantile paralysis over a year ago, while traveling in China,

Snite has kept alive by living in the pneumatic chamber that leaves only his head free. His trip started with a rail journey to Shanghai, where he entered a special "iron lung," constructed for shipboard travel, and sailed for San Francisco. Here he was transferred to still another "lung," and transported by rail to Chicago.



The paralysis victim looks on in mirror while two Chinese nurses feed him



The "iron lung" with its patient embarking on a transpacific liner



Electric Eye on Balloon Shows Flying "Ceiling"

CARRIED aloft on a balloon, a radio device perfected by the U.S. Bureau of Standards measures the safe flying "ceiling" in foggy weather. An electric eye measures the varying brightness of light as it ascends, and changes the pitch of a radio signal according the conditions encountered. On the ground, a recorder interprets this pitch in terms of safe flying altitude.



New Copying Projector Is Aid to Draftsmen

PROJECTING the image on a horizontal drawing board, a new aid for draftsmen can be used to copy the lines of complicated drawings, photographs, or textiles, full size or on a reduced or enlarged scale. The powerful lights used are cooled by an air blast to prevent damage to the original being copied.



TO HELP avert collisions at sea, a new sound detector determines the exact direction from which another ship's foghorn signal is coming. Cups at each end of a revolving arm pick up the sound and pass it along to the corresponding ears of observer, who turns the detector until the foghorn sounds equally loud in both of his ears.

which drug ingredients are extracted.

Pharmacy Students Operate Model Drug Store



Secrets of INSECT LIFE







A GLASS WINDOW IN AN EGG SAC What happens inside the egg sac of the Black Widow spider after the parasitic fly lays her eggs upon it? You can see for yourself, and even photograph the various scenes of the drama, by the process illustrated above. The side of an empty sac is cut away and the shell glued to the glass wall of an observation cage. When eggs are placed in the sac and the cage is covered with a mask, you can make shots like the one at the right

by the amazing pictorial history of the Black Widow spider, published in a recent issue. But didn't you wonder how such views could be made of what goes on inside an insect's egg sac? In this article, the photographer tells you how he did it, and shows you how you yourself can put glass windows in the secret places of nature



By George Elwood Jenks

her eggs, inclosing them in a tight bag of paperlike silk. Weeks later, a tiny hole appears and hundreds of almost microscopic spiderlings come popping out, spinning their miniature webs, just like mother used to make. Sometimes, the egg sac unexpectedly "hatches out" a flock of peppy little parasite flies. What has happened in the secret chamber of that egg sac?

Again, a fat, shapeless maggot stops eating a half-devoured trapdoor spider, and proceeds to spin a marvelous co-coon. Months later, a circular lid is cut open from within, and out comes a beautiful blue-black wasp! All this is plain to be seen, but what happened inside to change a skinful of spider meat into a delicate, highly organized, winged wasp?

Such questions always fascinated me. Now, after years of experimenting, I am photographing just such secrets of life, by putting glass windows in the walls of egg sacs, cocoons, and the sealed nests of insects.

You can do it too, and find a fascinating new world to explore, with a simple homemade outfit. If you have an enlarger and a fairly good small camera to start with, you probably can pick up an old view-camera frame for five or ten dollars—and that is all you need, except what you can make for yourself at home.

Of course, fine equipment is a great advantage. When my own ship comes in, I expect to have the best that money can buy. But expensive equipment is not essential. The Black Widow in photographs published recently (P.S.M., Aug. '36, p. 26), and those accompanying this article, were all made with the simple apparatus described here.

As shown in the illustrations, a photographing cage is simply a pair of glass plates sandwiched on a piece of wood or built-up cardboard in which an opening has been cut to receive the insects, egg sac, or cocoon to be studied. A sliding piece closes the opening at the top.

To put an observation window into a sac or cocoon, a section is cut out of its side and it is placed in a cage, with the opening against one of the glass walls. Then, with the cage set upright in its slotted wooden base, the photographer can watch for the mysterious life processes that he wishes to record.

Now as to my photographic equipment and some of the tricks I have learned by the trial-and-error method: My laboratory is the bathroom and the kitchen sink, all the developing being done at night with a blanket hung over the bathroom window. I use supersensitive panchromatic film (with-

Caught with Your Camera



out a filter), and develop in absolute method, in trays set on a wide board laid the long way of the bathtub. As I develop often, and usually only a few films at a time, I take the easiest way and use "M-Q" tubes, sixteen ounces of water to the tube, developing from six to ten minutes at sixty-five degrees according to the degree of contrast desired.

My shooting outfit consists of an old eight-by-ten view camera with a twenty-eight-inch bellows extension

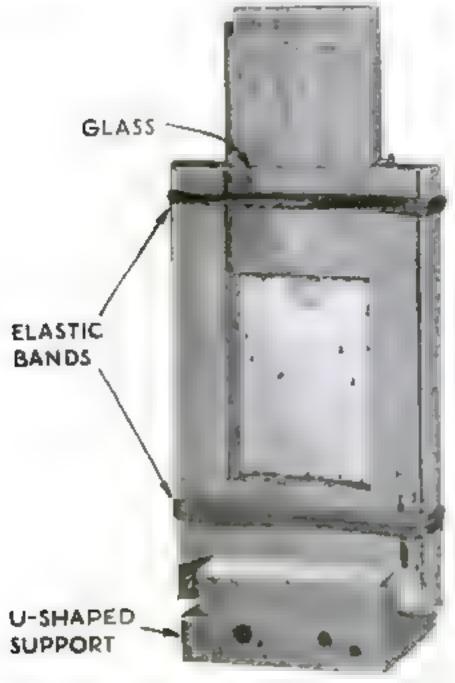
and a cheap lens, (F/6.3) from an old holder. All of my finished prints are darkness by the time-and-temperature post-card-size camera, set in a home- five-by-seven, usually enlarged from the made lens board.

> This lens has a 61/2-inch focus and, with the twenty-eight-inch bellows extension, gives me a four-times magnification on the negative. With an auxiliary copying lens I can get about a seven-times direct magnification, but this allows such a shallow depth of sharp focus that it can be used only with the smallest insects. For most of my work, I use two and four-times magnification, and have made a "reducer" out of an old eight-by-ten film holder, (to take five-by-seven film on one side and 31/2-by-5 on the other), making the slots by gluing on strips cut from the slide of another old film

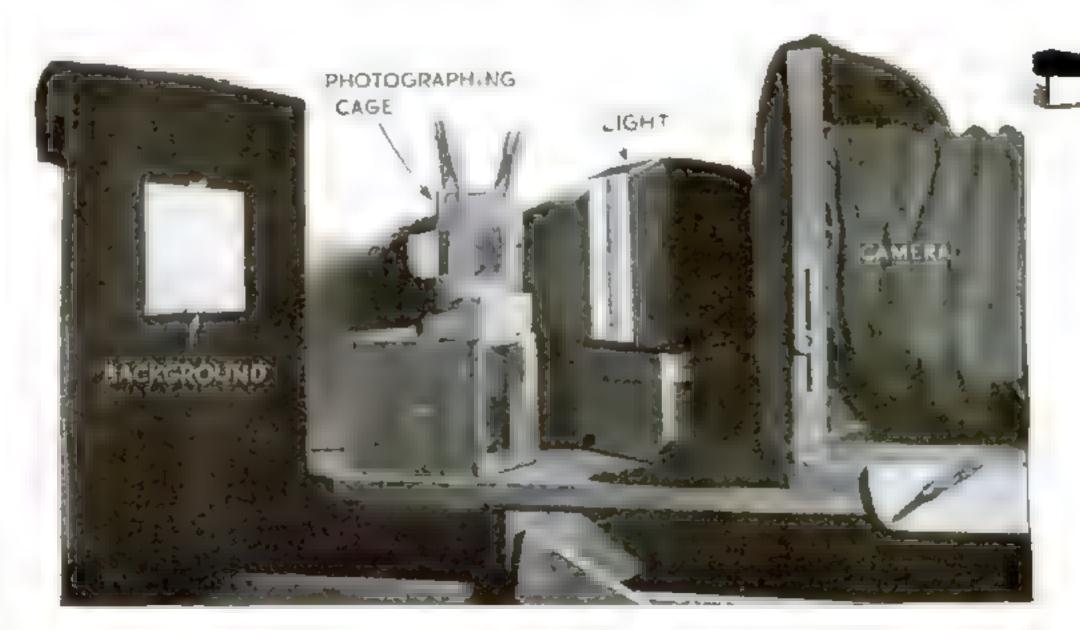
3½-by-5 size.

In this work, the eight-by-ten bellows is better than a five-by-seven, even when used with five-by-seven film, as the roomy bellows reduces the inside reflection explained later.

This camera, together with the cage stand and background easel, is set up as shown, on an eight-foot bench built like a rough carpenter's bench but well braced to prevent vibration. Both the top and the edge of the board used for a runway for the camera should be true and straight. A guide block is clamped to the camera track and, when the desired focus is obtained, the camera is clamped tight to the bench with a simi-



This photographing cage is so simple that anyone can build it in a few minutes. At the right is the arrangement for taking pictures





cially in photographing dead-black subjects like the Black Widow spider) is to light the subject as strongly as possible so as to cut the necessary exposure to a minimum. The greater the magnification, the longer the exposure required. When the short-focus lens is stopped down to its F/32 mark, for instance, and you are using a twentyeight-inch bellows extension, you are actually doing what amounts to "pinhole photography." And yet, in working with large insects, you must stop away down in order to get both the nearer and the farther legs in sharp focus.

So close-up, intense lighting is required, but it must be used carefully and sparingly. Intense light generates heat which, if too long continued, can easily kill some rare specimen, even when protected by a thickness of glass. So keep the lights well back when focusing and set them up close to the photographing cage only while making the exposure.

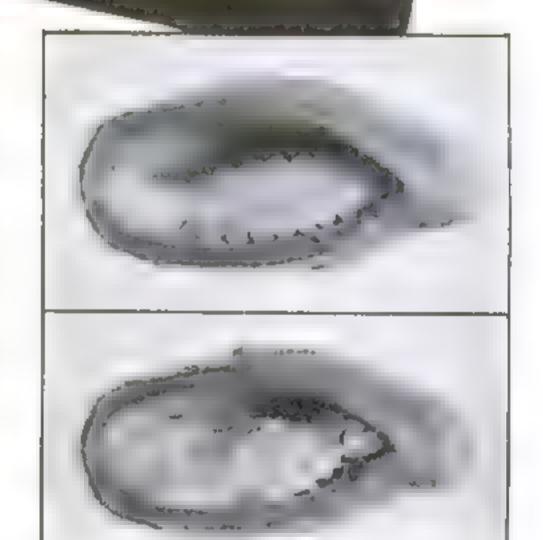
For subjects that will remain still, the No. 1 photoflood light is very good, for it can be studied and controlled. But for active insects, a No. 20 photoflash is almost a necessity. Your shutter need not be synchronized with the flash. In fact, you will need all the light of

the full flash in most cases. Place your flash switch on a solid block that can be moved up close to the front of the camera. Use one hand for the shutter bulb and one for the switch. Then watch patiently until the insects take the pose

you want—even if it is an hour or two! Then—open shutter—flash—close shutter. For most subjects, it is advisable to set a light cardboard reflector at the other side of the cage, to throw part of the flash light back into the cage and lighten the shadows, for the photoflash lighting is harsh at best.

For medium or dark subjects, shooting with the diaphragm set at the F/16 mark, for a four-times magnification at full bellows extension, I often set the flash within five or six inches of the cage, but you can settle these details for your own work by test and experiment.

A helpful cold-weather trick in working with constantly active insects, (like the Gaurax araneae parasites that go after the Black Widow's eggs), is to work in a cold room and chill some of the ambition out of them, then shoot



Two views of a cocoon found in a trapdoor spider's nest, showing a parasitic wasp's larva developing before the camera's eye

Below, the opening of the cage is stuffed with a soft rag while an egg sac is being fastened to the slide with glue



The "windows" must be kept clean for photographing, Here on extra piece of glass is being slid over the opening and the other removed



them while they are still cold. Even the photoflash is not fast enough to get a rapidly moving insect. Remember that with a four-times magnification, an insect is traveling across the negative just four times as fast as he actually is moving in the cage. The only sure way is to wait patiently until it slows down momentarily, and then shoot it "on the wing" as in duck hunting.

Probably the most important thing of all in this type of photography is to keep every ray of outside light away from the lens and the front of the camera. Perhaps you have read "instructions" to the effect that lights or light surfaces in front of the camera and "outside of the picture" are harmless and need not be considered. But that is the bunk except for amateurish snapshots! The (Continued on page 118)

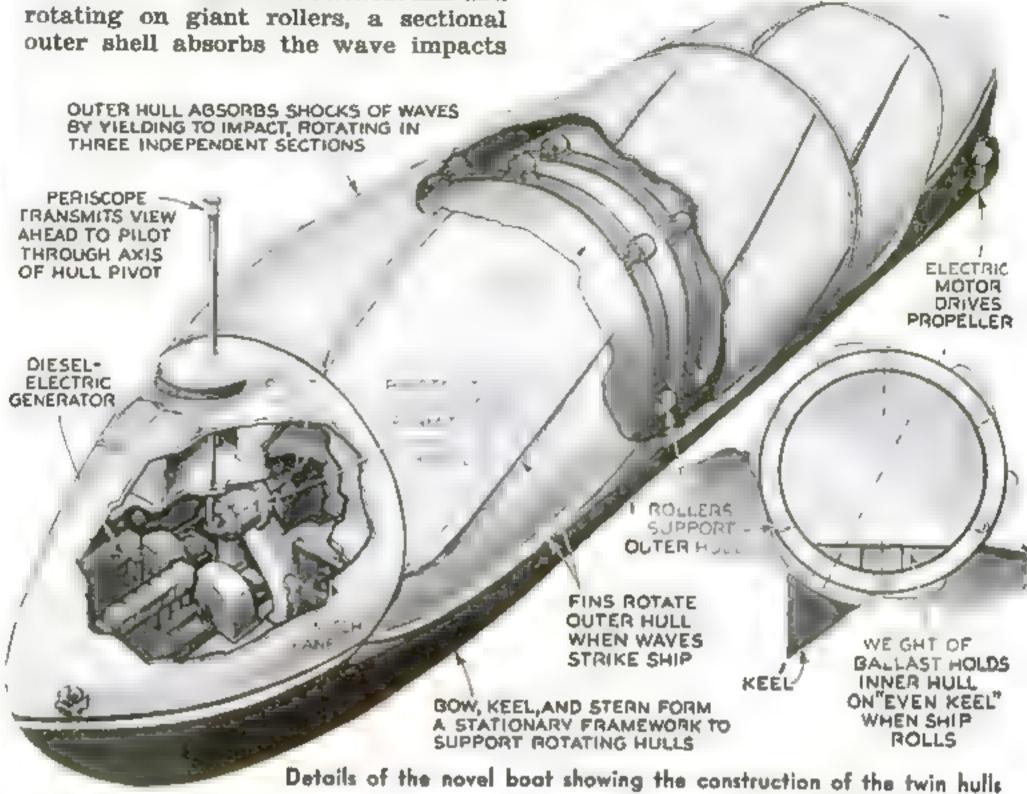
Novel Practice Club "Traps" Golf Ball

A NEW golf club designed for indoor practice traps the ball inside of the club head when a stroke is made. Under the impact of a practice drive, tiny-spring-operated doors in the head's face swing in to admit the ball. Practice strokes thus can be made in any room.

Ship's Revolving Hulls Eliminate Roll

TWIN hulls on a proposed ocean liner of new design revolve to absorb the shock of waves and keep the boat's cargo and passenger compartments on an "even keel." Fitted with helical fins and rotating on giant rollers, a sectional outer shell absorbs the wave impacts

while an inner hull, weighted with ballast, and pivoted to the stationary bow and stern, takes up the remainder of the ship's rolling motion.



Tame Bird Uses Strange Feeding Place



The tiny bird licking a bit of food from the rubber ball

A YOUNG bird, found and sheltered by Harry L. Galbarth of North Arlington, N. J., selected a small rubber ball as its foster parent. Whenever a bit of food is placed on the ball, the fledgling hops over to lick it off with a sweep of its tongue, as shown in the unusual photograph reproduced at the left.

Adjustable Racks Keep Shelves Neat

ADJUSTABLE racks designed for grocery, paint, and other package-goods stores keep merchandise constantly at the front of the shelves where it is easily accessible and well displayed. Laid on a shelf, the racks can be adjusted to accommodate small cans or packages of vary-

ing width. When a can is removed, the sliding frame of the rack is pulled forward and then pushed back into place. This action moves the remaining cans forward to insure neat, even rows of stock on the shelves.





Rubber Glove Removes Grime From Hands

HANDS caked with grease and dirt are easily washed with a "vacuum" glove just marketed. Made of crepe rubber, the glove is worn on each hand in turn as they are washed in the usual manner. As it is flexed, the rubber sucks dirt from the pores of the skin.





The photograph of the left shows the laudspeaker in one of the coaches of a sight-seeing train. Below, a microphone installed in the lacomotive cab to pick up noises of whistle and drive wheels

SPEAKING into microphones

that carry their voices to
loudspeakers in all cars, professional guides entertain railroad passengers with descriptions of historical sites, manu-

facturing centers, and other points of interest along the right-of-way, aboard sight-seeing trains recently placed in service by the Central Railroad of New Jersey. At intervals, a microphone in the locomotive cab brings the sound of

the whistle, the roar of the driving wheels, and an occasional word from the engineer and fireman. Names of the conductor and other members of the

From the baggage cor, on "announcer" colls passengers' offention to points of interest train crew are announced as they pass through the cars, thus introducing them

to the passengers. Musical selections from an electric phonograph are heard from time to time. Instead of going through the cars ringing a gong, when dinner is served in the dining car, a waiter sounds chime bars and makes the announcement by loudspeaker.



One movement of the lever makes two changes of gear

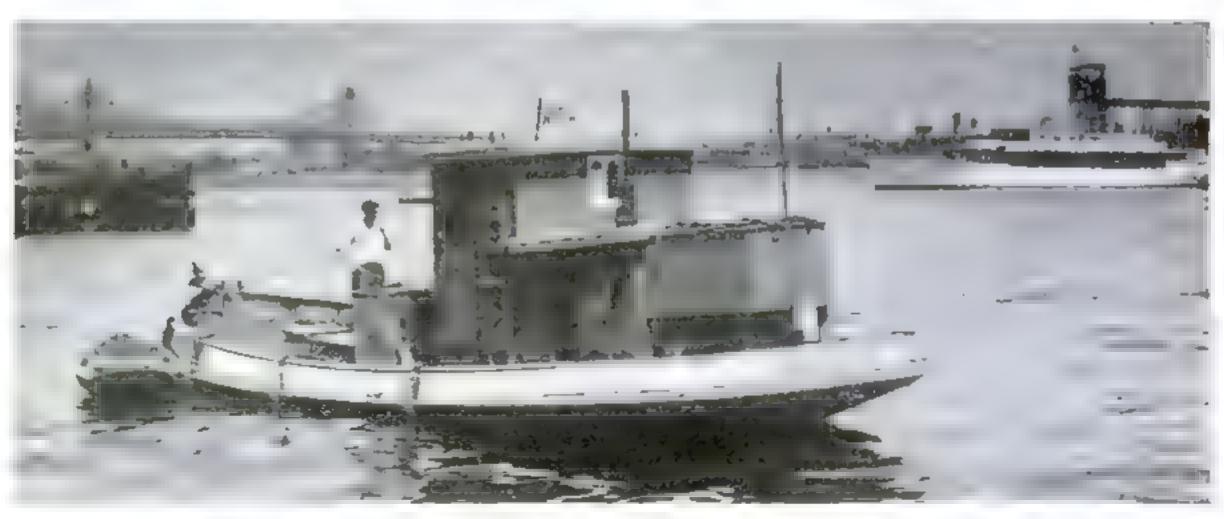
New Gear Shift Simplifies Driving

A NEW type of automatic gear shift, available on a car of popular make, is controlled by a lever on the steering post. To use the car's four forward speeds, the driver employs the clutch pedal only in starting. When the gearshift control lever is advanced to the first of its two "forward" positions and the clutch is let in, the car moves forward in low gear and shifts of its own accord into second speed. The driver then flicks the lever to the next position and the gears automatically progress to third and fourth speed, the last being a special high gear that reduces the engine's revolutions for fuel

economy at high speed.

"Water Boat" Supplies Yacht Owners

SELLING drinking water to owners of yachts and motor boats, at half a cent a gallon, is the unusual occupation of Joe Hanson of New York City. The illustration at right shows him aboard his "water boat" in the East River, where many of New York's pleasure craft lie at anchor.



Joe Hanson aboard the unusual craft in which he delivers drinking water to yachts moored off New York City

Tiny Streamliner Needs No Track

'DRIVEN by a batterypowered electric motor, a streamline, trackless train was a popular feature at a recent railroad convention held at Atlantic City, N. J. Consisting of a power car and three passenger units, the diminutive counterpart of a high-speed streamliner is shown in the photograph at the right as it carried convention visitors on a sightseeing trip along the boardwalk of the seaside resort.



A seaside boardwalk is the roadbed for this midget train, used to entertain delegates to a railroad convention

Light Shovel for Miners

BECAUSE he moved from fifteen to twenty tons of coal a day, Thomas Telford, a Logans Ferry, Pa., miner, developed a new shovel made of aluminum to lighten his daily labor. The new mining tool lessens the weight of each shovelful of coal by about two pounds. Other miners now are adopting similar shovels made of the light metal.

Twelve-Foot Airplane Makes 225-Mile Speed



Portable Laboratory Tests Electric Stoves



The portable tester being used to check an electric range

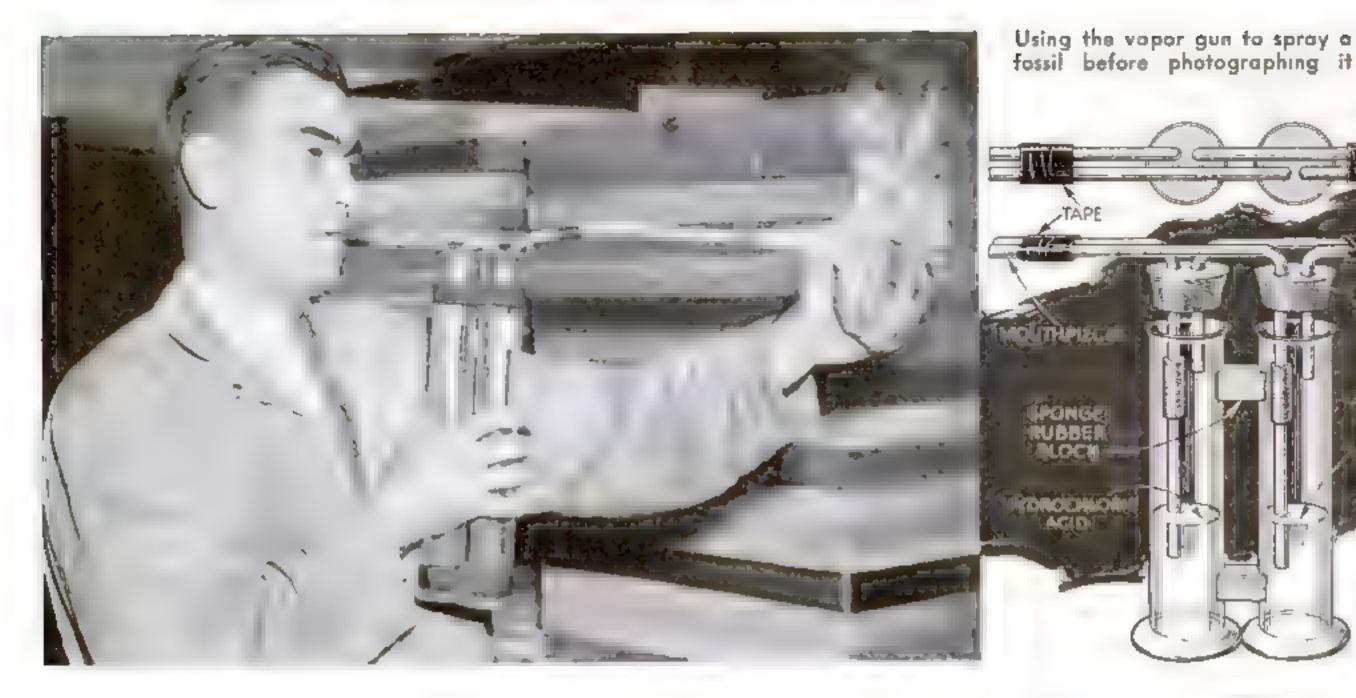
FOR testing the efficiency of electrical cooking equipment, a new portable laboratory can be used on any common kitchen appliance. Included in the testing unit are a humidity indicator and a room-temperature thermometer for recording the conditions under which tests are made, as well as a group of electrical instruments to regulate and gauge the current consumption. Temperatures reached in different parts of the equipment being examined are measured electrically.





New "Glove" Aids Golfers

DESIGNED to make the left hand's gripping power equal to that of the right, a new "glove" for golfers is said to force the user to hold the club properly and improve his stroke. Resembling an ordinary fingerless glove, the device is equipped with a narrow leather strip that locks the thumb in the correct position on the club shaft, and serves to stop the user's back swing at the proper point, guiding the club head down naturally and evenly it is claimed, for a perfect stroke.



Novel Smoke Gun Will Help You Get

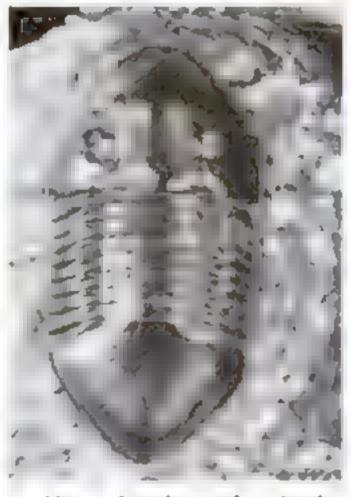
BETTER PHOTOS of TINY OBJECTS

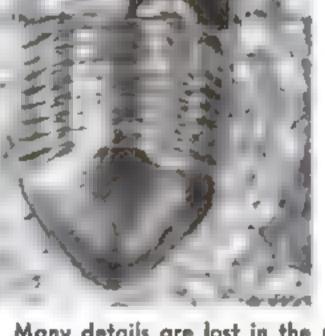
OW many times have you shown your friends a photograph of some small object, and then said, "There's a little curlicue right there, but the light was bad and it didn't show up"? For example, the coin shown in the illustrations on this page was photographed twice under exactly the same conditions, except that in the lower picture, the details of the coin were literally "smoked" into relief.

In photographing objects which throw extremely strong high lights, or when there is a finely constructed bit of design that you want thrown into relief, try coating the object with a thin layer of ammonium hydroxide-hydrochloric acid vapor.

The simple vapor gun I use for this purpose, while makeshift in appearance, is inexpensive and can be put together by any amateur photographer or laboratory student. The only materials required are a couple of long, narrow glass bottles, a few feet of quarterinch glass tubing, a roll of electricians' tape, a short length of rubber hose, two rubber stoppers, and two small pieces of rubber sponge.

The two laboratory-type bottleslarge olive bottles can be used as substitutes-are fourteen inches long and two inches in diameter. From the glass tubing I made two mouthpiece tubes, one ten and the other twelve inches long; two vapor tubes, one seven and the other nine inches long; and four extension tubes, two of them eight inches long and the remaining pair two inches long. The rubber tubing provided four joints, each three inches long; since these were used in joining the glass tubes, they



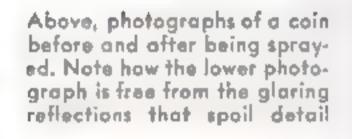


Many details are lost in the picture of the fossil trilobite at the left. The same fossil, smoked, is illustrated at right

had to have holes of quarter-inch diameter. Each of the rubber stoppers was bored for two holes, slightly off center to allow for the overlapping of the glass tubes.

Mouthpiece tubes and vapor tubes were bent at right angles about three inches from one end, and these ends were thrust through the holes in the stoppers, as shown in the accompanying diagram. To the ends of the mouthpieces which would extend down into the bottles I attached pieces of rubber tube and inserted one of the eight-inch glass tubes in each. Then the two remaining rubber tubes were used to cover the free ends of the vapor tubes. and one of the two-inch glass tubes

JACK B. PENFOLD



Two views of the vapor-spray gun, showing how the flasks and tubes are put together

was inserted into each. The two bottles were bound together at top and bottom with electrician's tape, with pieces of sponge rubber between them for added steadiness. Tape was also used

to bind the free ends of the mouthpieces and of the vapor tubes to keep them from flopping around when applying the vapor to the object. By trial and error, I finally got the eight-inch extension tubes adjusted so they would be about half an inch from the bottoms of the bottles when the corks were inserted. It was to facilitate this adjustment that rubber tubing was incorporated—and, besides, it is easier to work with shorter pieces of glass.

After making these adjustments in your vapor gun, pour just enough concentrated hydrochloric acid into one bottle to fully cover the ends of the extension tube, and the same amount of concentrated ammonium hydroxide into the other bottle. Fit the corks anugly into the tops of their respective bottles.

In using this (Continued on page 130)

Un-Natural History GUS MAGER

SANDALS WHIP (GIRAFFE SKIN)

FEW PEOPLE WOULD THINK THE GENTLE GIRAFFE

THICK-SKINNED...
YET HE HAS A SKIN AN INCH THICK, AND THE TOUGHEST
AND MOST DURABLE OF ALL ANIMALS, EVEN
OUTLASTING RHINOCEROS HIDE.



THE MYSTERIOUS CLICKING NOISE THAT A REINDEER MAKES WITH HIS FEET HAS LONG BAFFLED THE HIGH-BROWS OF NATURAL HISTORY. ACCORDING TO THE LATEST THEORY, THE CLICK IS NOT AN OUTSIDE NOISE PRODUCED BY THE HOOFS, BUT COMES FROM WITHIN, BEING CAUSED BY A TENDON SNAPPING OVER A BONE,

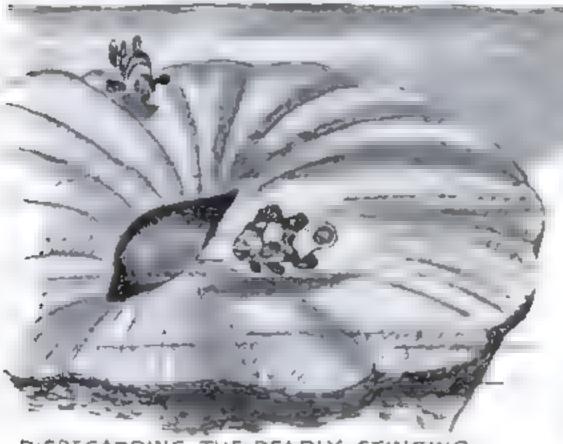


BALONRY TO THE FUZZY LITTLE AUSTRALIAN TEDDY BEARS, THE KOALA

AUSTRALIAN TEDDY BEARS, THE KOALAS.
THEY LIVE ON EUCALYPTUS TREES, YET HAVE THE
HARSHEST, MOST RAUCOUS VOICES IN ALL AUSTRALIA!



IN SPITE OF HIS MILITARY LOOK, THE SERGEANT-MAJOR FISH, SOMETIMES CALLED A COW PILOT BECAUSE HE HANGS AROUND THE CLUMSY COW FISH APPARENTLY GUIDING IT TO FOOD HIDDEN IN THE SAND, IS REALLY NOTHING BUT A SLY MOOCHER. HE SIMPLY STANDS BY AND SNAPS UP THE TITBITS AS FAST AS THE POOR OLD POKE UNCOVERS THEM WITH HIS BLOWING!



THREADS THAT LINE THE GULLET OF THE
GIANT SEA ANEMONE, THE TINY

CLOWN FISH OFTEN DARTS IN

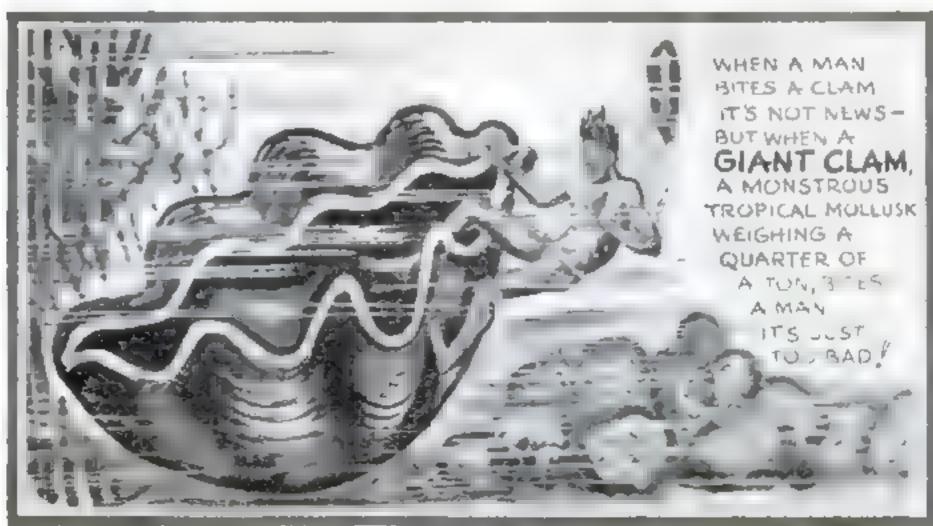
THROUGH THE OPEN MOUTH OF THE

FISH-EATING PLANT TO HIDE, OR TO HELP

ITSELF TO A FREE LUNCH IN THE MONSTER'S

STOMACH, AND SWIMS OUT AGAIN

AS FRESH AS A DAISY



SPECTACULAR STUNTS WITH

METAL BURNS IN SUPERHEATED STEAM

Metallic magnesium, placed in the horizontal glass tube, burns brilliantly in an atmosphere of steam. The water vapor is superheated by passing it through a hot copper coil

and interesting experiments for the amateur chemist. With simple apparatus, you can make your breath burn, light a cigarette with steam, and perform many other novel tricks that will amaze your friends.

To show that your breath actually will burn, you will need a lamp chimney, or a bottle with the large end cut off. Fit the smaller end of the chimney, or the mouth of the bottle, with a cork carrying a glass or metal tube, which serves as an inlet for illuminating gas. Cover the larger end with the lid of a tin can, pierced at the center with a three-quarter-inch hole. This lid need not be gas-tight around the edges. If the cap is too large, pieces of cork may be inserted loosely around the edges to hold it in place.

If your home laboratory is not piped for gas, you can "borrow" it from the kitchen range by removing one of the range burners with its attached ports. Thrust the end of a length of rubber tubing over the orifice spud or "gas hole" in the body of the gas cock, and the latter will then control the flow of gas as usual.

Turn the gas on gently, and after about ten seconds apply a lighted match to the hole in the tin-can lid. The issuing gas will ignite and burn with a yellow flame. The ten-second interval allows time for expelling the air in

FOR

HOME CHEMISTS

the vessel. If the gas is lighted too soon, the gas-air mixture will produce a mild explosion, but there is not the slightest danger because the three-quarter-inch hole in the tin-can lid is amply large enough to relieve the sudden pressure.

While the flame is burning at the end of the vessel, insert a ten or twelve-inch glass or metal tube in a length of rubber tubing. Blowing gently and steadily into the rubber end, pass the outlet tube right through the

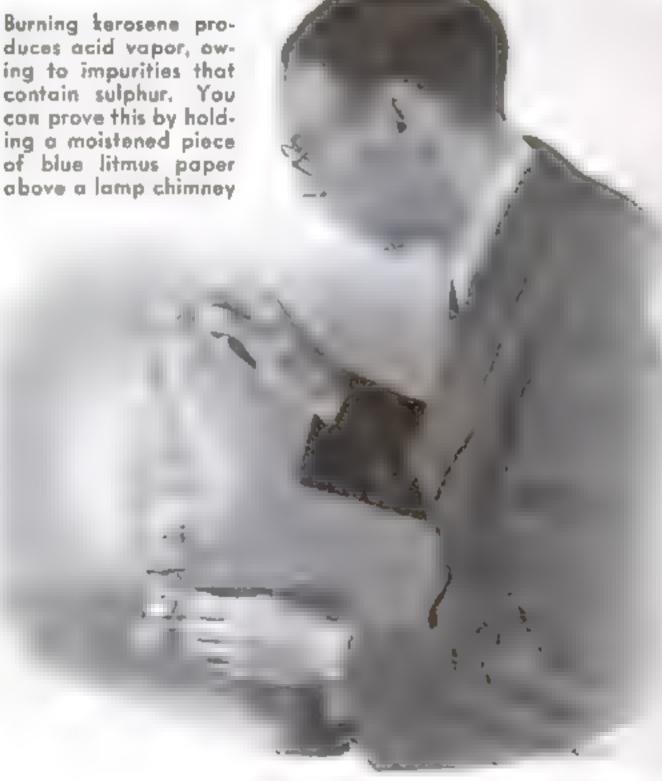
yellow flame and into the chimney or bottle. The tube carries a flame of its own along with it, and you will see your breath burning in the interior of the vessel! It will continue to burn as long as you blow into the tube, feeding the

flame with left-over oxygen from your lungs. Air from the inflated bladder of a football or basketball will produce the same effect.

Because you are accustomed to seeing gas burn in air, it seems a topsyturvy state of affairs when air burns in gas, but that is a perfectly correct way of describing what happens here. To a chemist, who calls this "reciprocal combustion," there is nothing surprising about it. He regards burning simply as the combination of oxygen and some other substance; and it makes no difference to him which one happens to surround the other at the time, for the net result is exactly the same.

A Bunsen burner produces a blue, or nonluminous, flame when it is getting all the air required for combustion. One way to turn the flame yellow is to cut down the air supply, by closing the air ports at the base of the burner. Another way is to heat the gas before it burns.

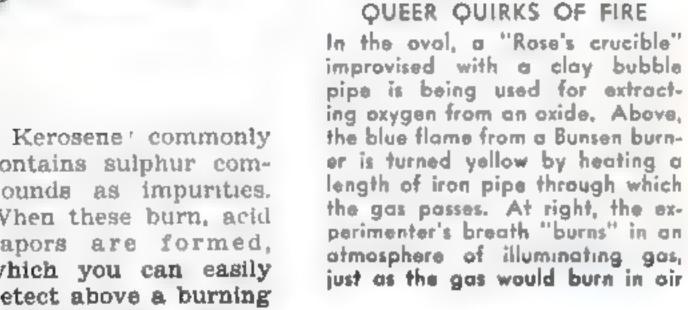
To show this curious effect, connect a piece of iron pipe to the top of your Bunsen burner with a short length of rubber tubing. The pipe should be of about the same diameter as the burner stack, and at least a foot long. Turn on the gas, light it at the top of the iron-pipe extension, and adjust the gas supply and the burner's air ports until the flame turns blue. Now, with another burner, or a gasoline blowtorch, heat the extension of iron pipe. The blue flame will slowly turn yellow. By repeatedly heating the pipe and letting it cool, you can prove that the yellow color of the flame is not due to the volatilization of any oil or other combustible substance on the inside of the pipe. The real cause is an action known as "thermolysis." Heating the unburned gas tears apart some of its moleculesbreaking up methane, for example, into hydrogen and free carbon, or soot. These particles of carbon, glowing to incandescence, turn the flame luminous.





Making Your Breath "Burn" in Illuminating Gas, and Lighting a Cigarette with Steam, Are Among the Startling Effects That Show the Nature of Fire

RAYMOND B. WAILES



contains sulphur compounds as impurities. When these burn, acid vapors are formed, which you can easily detect above a burning kerosene lamp. Hold a

moistened piece of blue litmus paper over a lamp chimney, and in a very few seconds the test strip will turn red, showing the presence of acid.

Even more striking than air burning in gas is the spectacle of metallic magnesium burning in an atmosphere of steam. To perform this beautiful experiment, boil water in a small flask

(or empty beer can) and lead the steam that is generated through a "superheater" made of several turns of copper tubing, bent into a spiral and heated red-hot with a Bunsen burner. Then let the steam pass through a glass tube, a quarter of an inch or half an inch in diameter and six to eight inches long, containing some magnesium metal

> in ribbon or powder form.

After you have generated steam, an alcohol lamp or candle placed under the flask will maintain a slow current of vapor through the apparatus. Now and then, remove the



Here illuminating gas is being passed over copper oxide in a hot tube. It extracts the oxygen it needs for supporting combustion

Bunsen burner from the superheater and wave the flame across the glass tube containing the magnesium, to heat it in turn. When the superheater becomes cherry-red, direct the flame more intensely and frequently on the glass tube. Soon the magnesium will become hot enough to react with the steam and take fire. It burns with a dazzling white light, just as it does in air.

This seems strange indeed, when you consider that steam is often used for smothering fires, because it shuts off the supply of oxygen from the air. When the steam is superheated, however, magnesium is able to obtain the oxygen necessary for combustion by tearing apart the water molecules of the vapor. The metal burns and forms magnesium oxide, which will coat the inside of the glass tube. Hydrogen gas, from the wreckage of the water molecules, escapes with the excess steam and burns at the open end of the glass tube.

By detaching this tube, you can use the flask and superheater coil to demonstrate some of the surprising attributes of superheated steam described in an earlier article of this series (P.S.M., Aug., '35, (Continued on page 135)



Latest Inventions for

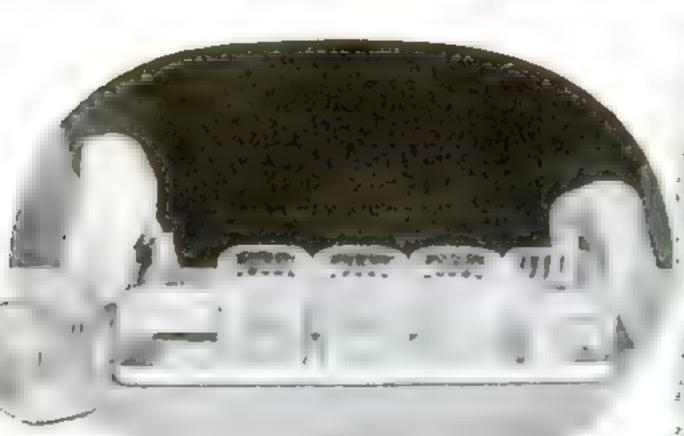
AUTOMATIC COFFEE MAKER. From the time the coffee and water are put in, and the electric current is turned on, the coffee maker at the left operates automatically. After the caffee has been brewed, a device turns the current off so the liquid can filter down into the metal urn. As it cools, the heat comes on again to hold the beverage at an even temperature. Coffee is drawn conveniently through a spigot in the urn

> SCIENTIFIC KITCHEN KNIVES. Designed like surgical scalpels to fit the hand and give perfect balance, new-style kitchen knives like those illustrated below are said to give much greater ease and efficiency in paring fruits and vegetables. Various shapes of blades are available, adapted to different kitchen uses

HORIZONTAL **CUP HANDLES** Horizonto! handies, instead of

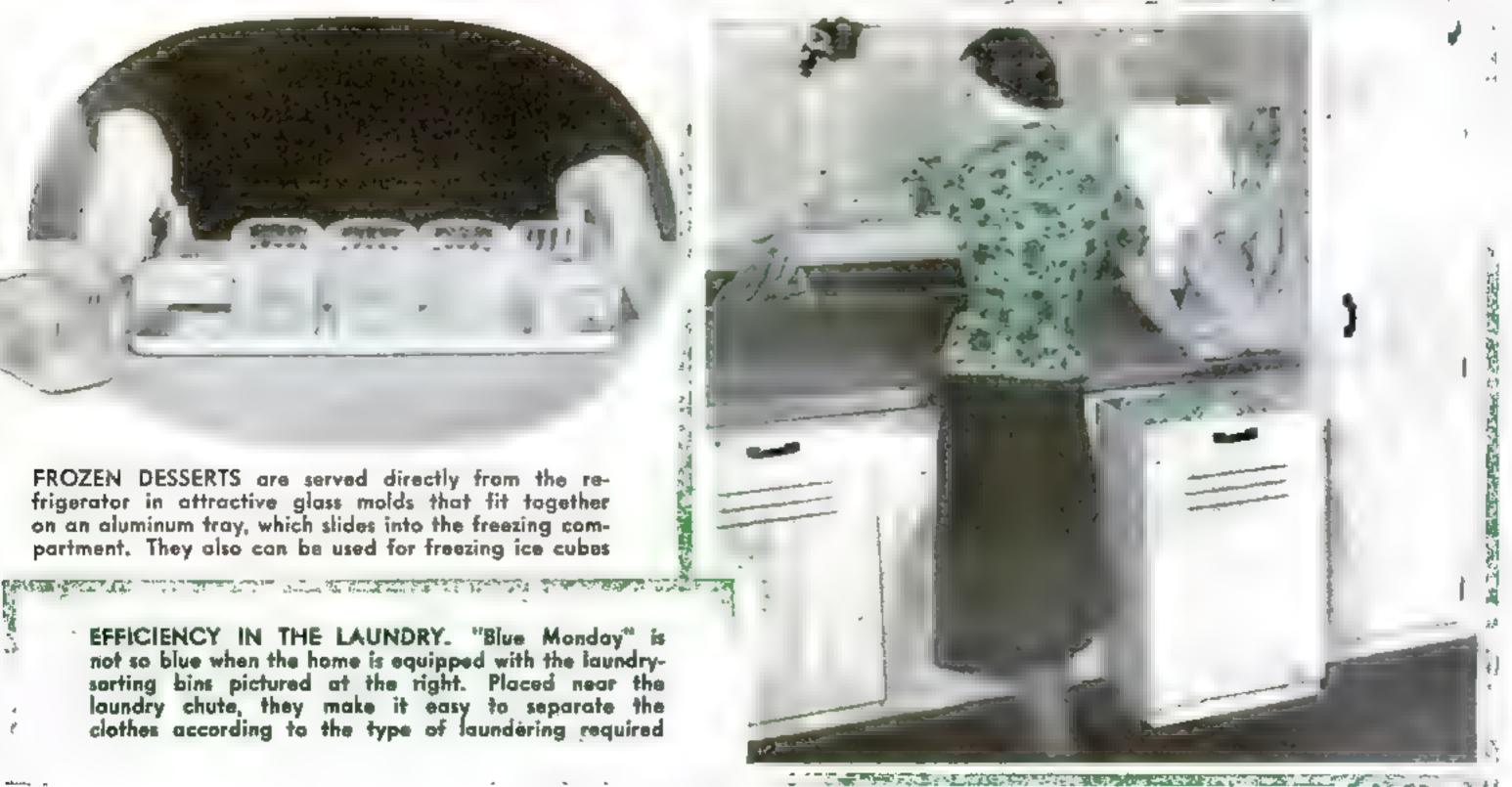
the usual vertical kind, make coffee cups nest easily and are handy rests for cigarettes. They are shown at right with a rack holding six cups and saucers neatly





FROZEN DESSERTS are served directly from the refrigerator in attractive glass molds that fit together on an aluminum tray, which slides into the freezing compartment. They also can be used for freezing ice cubes

> EFFICIENCY IN THE LAUNDRY. "Blue Monday" is not so blue when the home is equipped with the laundrysorting bins pictured at the right. Placed near the loundry chute, they make it easy to separate the clothes according to the type of laundering required



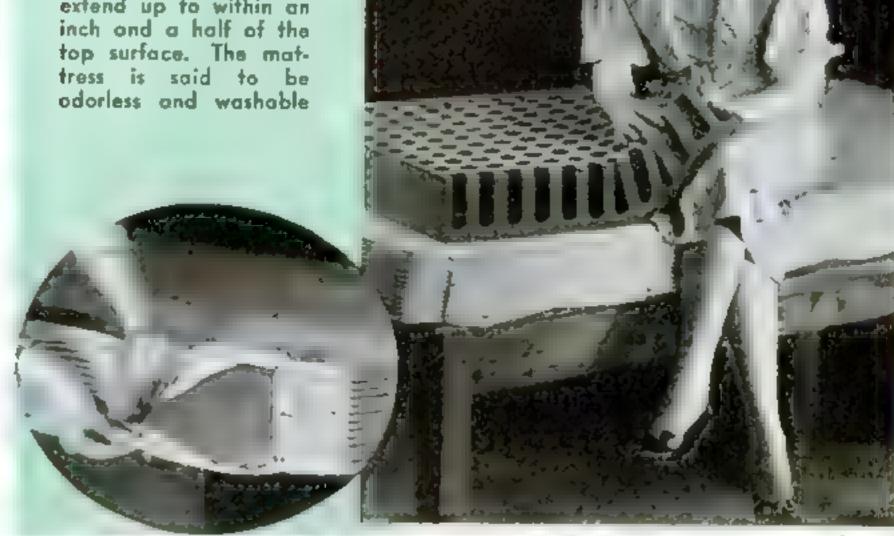
the HOUSEHOLD



"DRUMSTICKS" of minced chicken are turned out easily with this aluminum mold. The meat, packed around a wooden stick, is pressed firmly into the desired shape by squeezing the handles of the tool. This method of serving minced chicken presents a pleasing novelty and makes the meat easier to eat

RUBBER MATTRESS

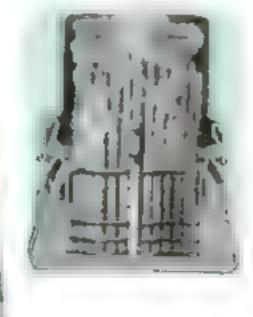
Latex, a material resembling sponge rubber, is used throughout in the construction of this novel mattress. The bottom part is honeycombed with cylindrical cells that extend up to within an inch and a half of the top surface. The mattress is said to be adorless and washable



COOKER FOR ASPARAGUS. A whole bunch of asparagus is placed in this novel steaming rack designed for use with any type of double boiler. Supporting the stalks in the lower half of the boiler, while the upper half serves as a lid, the rack allows ends to boil while tips are steamed



SHREDDER. Onions, alives, nuts, cheese, and similar materials can be shredded in the device shown above, without leaving an odor on the fingers. The food is put in the container and pressed against the sliding blade



How the wire rack is used in a standard double boiler



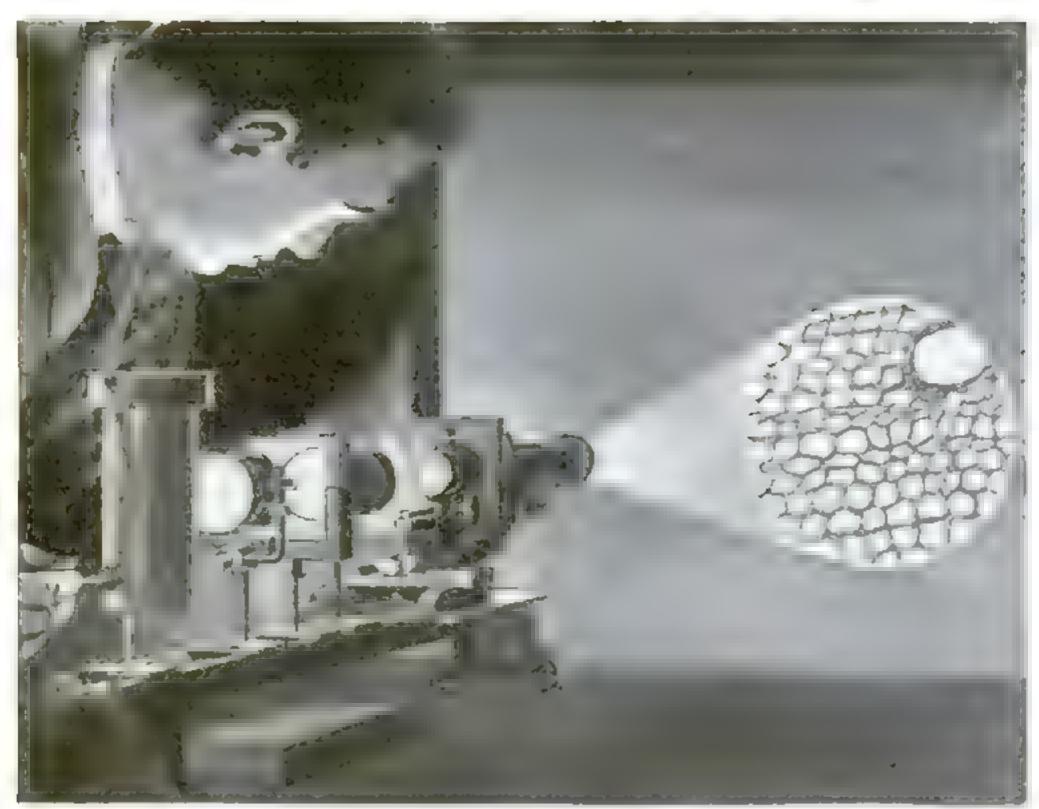
Made of ciled silk, these light, coal slippers are not harmed by water. Provided with elastic tops, they can be slipped on easily as one leaves the shower to prevent tracking water onto the bathroom floor. Supplied with an oiled-skin case, they can be stowed in a suitcase for use on trips





ODOR DESTROYER. Sprayed into the garbage can, as illustrated above, a new preparation kills unpleasant odor. Simmering in a pan on the stove, it overcomes cooking smells

Hitch a Magic Lantern



The microprojector in use. It has a polarizing disk on the microscope eyepiece for polarized light

HE microscope hobbyist who has reached the point where he wants to do something more than merely look into the eyepiece of his instrument and see a magnified image of whatever is on the slide, will welcome the increased opportunities that a microprojector brings.

A microprojector is, essentially, very much like the lantern-slide or motion-picture projector that throws an enlarged image of a photographic slide or film on a screen. Its projection lenses are those found in a compound microscope, and its slides are the type ordinarily employed in microscopic observation. Unlike a lantern-slide projector, however, it projects an image of the

original object, instead of a photograph.

A microprojector consists essentially of a source of strong light, a microscope, and a system of lenses for directing the light through the object and into the objective lens of the microscope. Generally, the tube of the microscope rests in a horizontal plane. In this position, it can be used with all permanent slides and with many live specimens swimming in water beneath a cover glass. However, for the projection of most live specimens, and other objects that might run or fall off the slide, a vertical microscope generally is better. In such a case, a mirror or prism, placed just above the eyepiece, With Your Regular Instrument and a Few Odds and Ends, You Can Rig Up a Microprojector That Will Throw the Enlarged Images of Microscopic Objects on a Screen for Entertaining Large Groups of Your Friends

By MORTON C. WALLING

intercepts the upward-moving light rays and directs them at right angles, so they will strike a vertical screen.

There are so many possible sources of light, so many kinds and arrangements of condensing lenses, and so many accessories such as polarizers and water cells, that it is next to impossible to describe an ideal microprojector. Therefore, I shall do the next best thing, and describe an instrument, built largely of inexpensive parts, that can serve as the basis for development of a projector to meet the specialized needs of the individual. This instrument, because of its flexibility, is in itself an excellent experimental project, for it can be used to try out various arrangements of condensers, and for other research.

Essential parts of the microprojector are: the base, source of illumination, condensing system, water cell, polarizing system, and microscope. Since you will, no doubt, want to use the microscope you already have, it really should



The lamp assembly, showing how the bulb is mounted on the lathe bed that forms the base of the instrument. Note the lamp housing

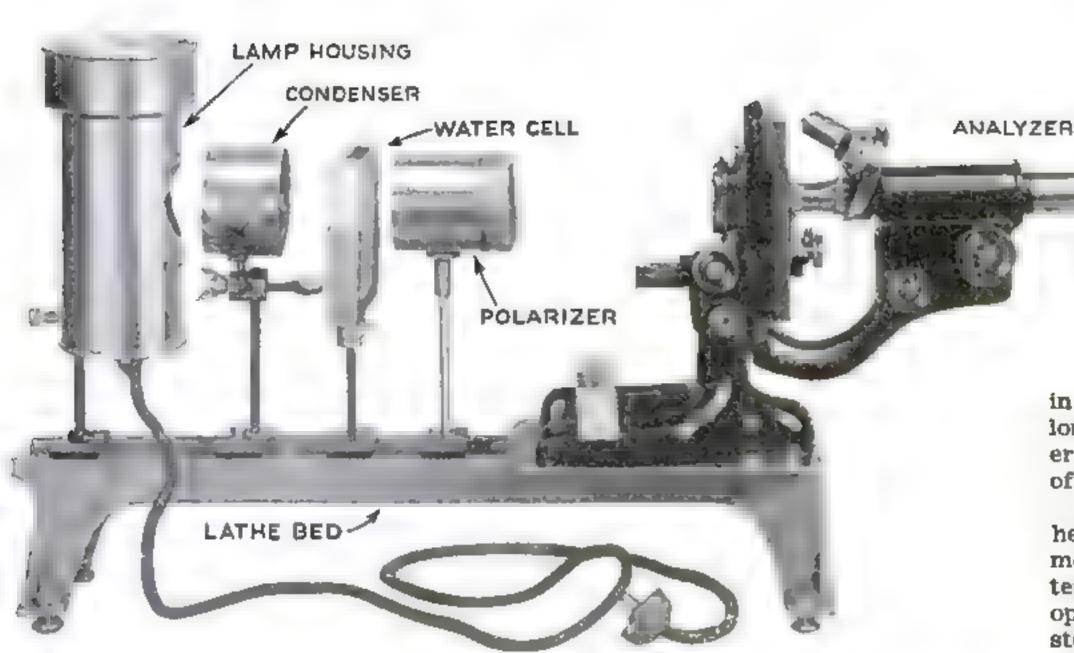


Two sixty-millimeter plano-convex lenses of three-inch focal length, held in a special mount, make the condenser unit shown above



To protect delicate slides from radiant heat, a simple water cell is interposed between the condenser and the specimen when needed

to Your MICROSCOPE



Assembly of the various units of the microprojector. Drawings below give construction details

be considered the starting point. The height of the center line of the tube above the bed of the instrument, when the tube is horizontal, determines the distance from the bed to the centers of the lamp filament, condensing lenses, and other optical parts.

The base of the microprojector is a cast-iron lathe bed, about eighteen inches long. Such beds are used for very small wood-turning lathes, and can be purchased at hardware stores and other dealers handling home-workshop tools, for about a dollar. The bed has a slot running for most of its length, and the top surfaces of the ways, or rails, are ground level. In selecting a base, pick out one that looks reasonably straight when you sight along its upper edges. An optional improvement is to install non-marring feet, two of which should be adjustable so the bed can be leveled on an uneven bench or other surface.

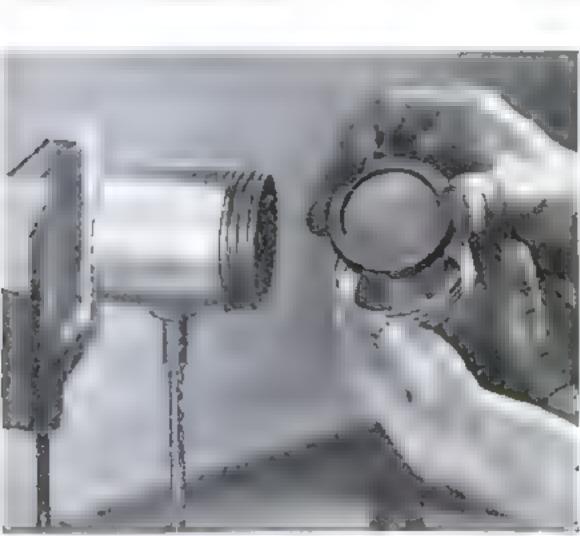
For the light source, you can use a 100-watt (or larger) projection lamp; a 108-watt, six-volt microscope illuminator lamp, or a six-volt automobile headiamp. The 108-watt lamp and automobile bulb require a transformer for operation. You can buy special transformers for the microscope lamp, but it it cheaper to employ an ordinary toy transformer of 150 watts rating, with a six-volt tap. Be sure that the wattage rating is great enough to handle the lamp, or maximum brilliancy will not be obtained.

ONSTRUCTION of the lamp support and housing is shown in the photographs and drawings. The method of mounting the upright rod is important, because it also is used for other units of the projector. This upright consists of a quarter-inch steel rod threaded at one end. A machine bolt with the head cut off will do nicely, if it is long

enough. This length, incidentally, depends on the height of the optical axis of the microscope above the lathe bed. Cut a block of brass or steel measuring about one-eighth by one inch, and as long as is necessary to reach across the lathe bed. In the center, drill a hole and tap it to thread over the end of the upright. Use a washer and nut, preferably a wing nut, to fasten the upright

in position. This arrangement makes longitudinal adjustment easy, and lateral adjustment is possible to the limit of the width of the slot in the lathe bed.

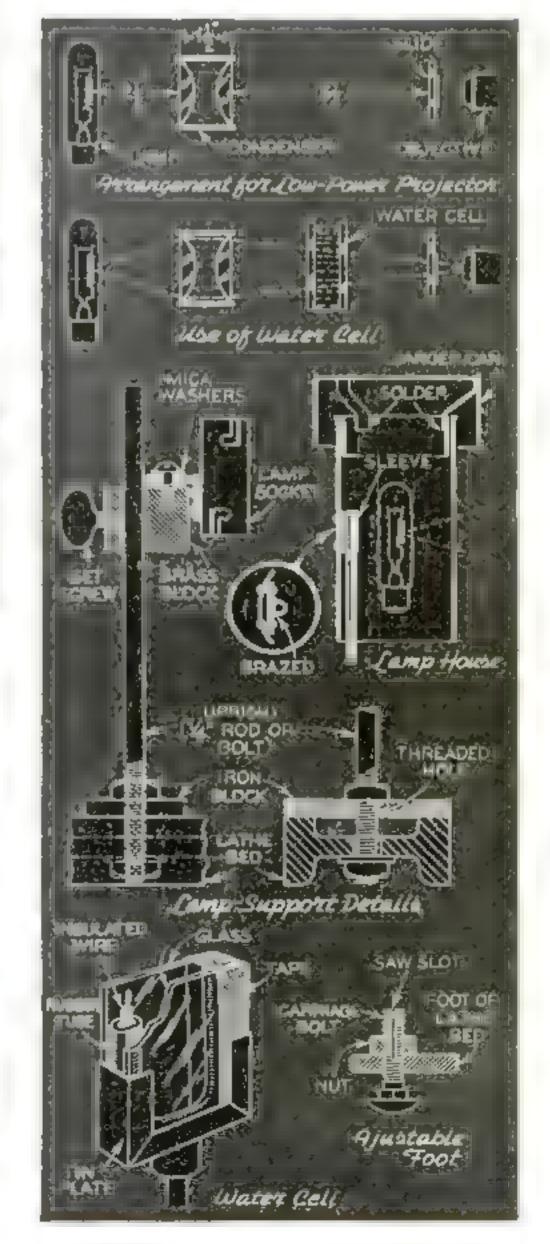
The lamp must be adjustable for height, and have some side-to-side movement as well, so that it can be centered with respect to the rest of the optical system. A block of brass or steel, drilled to slide freely over the upright, and provided with a wing set screw to lock it in position, supports the socket and provides these adjustments. You can (Continued on page 131)



A holder for the polarizer disk, improvised from a cardboard box with a screw lid. This disk is placed between the water cell and the end of the microscope



The analyzer disk is mounted over the microscope eyepiece in a holder made from a threaded jar lid and wire clip



HOME TESTS SHOW LAWS OF

PLANT LIFE

Leaves Give Off Water Drawn from the Soil

Moisture drawn up from the soil through a plant's stem travels through the entire plant and escapes into the air through the stomata, or pores, in the leaves. You can prove this by placing a leaf under a jar, as shown at the right, with its stem passing through a hole in a cardboard platform into a vessel of water. When the apparatus is placed in the light, water vapor escaping from the leaf will cover the inside surface of the jar with dew, the moisture being drawn from the water in the lower vessel. The cardboard platform, with a small hole to admit the stem, insures that no vapor passes directly between the two vessels.





Seeds Exhale Carbon Dioxide Gas

TIE a spoonful of seeds in a cloth bag and suspend it in a closed jar containing limewater. After a few days, the limewater will turn white. Blowing your breath into limewater also will turn it milky, the change being due in both cases to carbon dioxide gas, exhaled by man and plants alike.

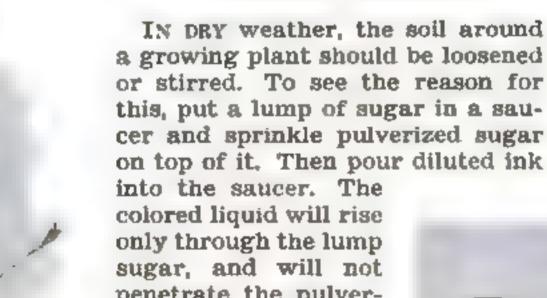
> Roots change their direction when the container is turned

Simple Experiment Shows How 'Plants "Pump" Their Food



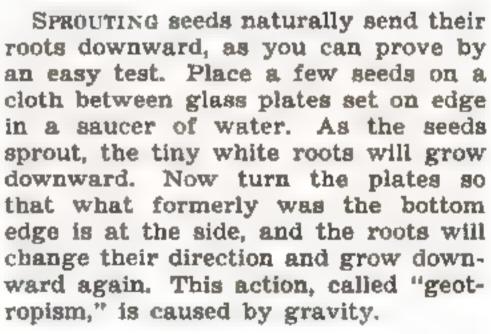
Osmosis, the process by which moisture enters roots of plants and is distributed through them, is demonstrated by filling a hollow in a pared potato with sugar and water, and suspending it in a glass of water. The water is drawn up through the cells of the potato and dilutes the sugar sirup in the hollow, increasing its volume until it actually overflows the edges. This experiment makes a striking stunt to prove that water really can run uphill, and shows the strange force that is responsible formany of the most important functions of plant life.

Why Loosening Topsoil Preserves Moisture



penetrate the pulverized sugar. In this experiment, the lump represents hard soil and the pulverized sugar loosened soil. Stirring the topsoil makes an insulating layer to keep moisture below the surface.

Force of Gravity Makes Roots Grow Downward





How To Measure a Plant's "Blood Pressure"

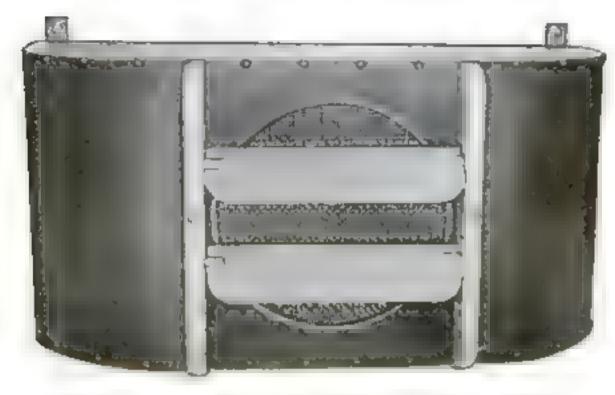
THAT the flow of water in a plant actually sets up pressure can be shown by connecting a glass tube to a cut-off stem, as illustrated at the right, and putting colored water in the tube to serve as an indicator. As moisture is drawn from the damp soil by the plant's roots, the colored water will rise in the tube. A string tied around the glass at the original level will enable you to observe the change as it takes place.





New Ideas for Radio Fans

Loudspeaker Enclosure Improves Tone



Adjustable deflectors throw sound in any direction

Serving as an acoustic baffle, a new loudspeaker mounting accommodates all types of
speakers up to thirteen inches
in diameter. Designed to eliminate resonance and vibration,
the cabinet is fitted with outside deflector fins which are
adjustable to throw the sound
in any direction, suppressing
undesired high-frequency tones.
The unit can be mounted horizontally, as shown, or in an
upright position on convenient
brackets.

Tube Shows When Receiver Is Tuned

In one of the latest types of visual-tuning-indicator tubes for use with broadcast receivers, a circle of light shows when the circuit is accurately tuned to a station's signals. When no signal is being received, a fluorescent glow in the shape of a narrow ring is visible at the end of the tube. As the receiver is adjusted to bring in a signal, the glowing ring becomes wider and wider, until it almost fills the tube's end when the station is properly tuned.

New Tube Tester Has Built-in Data Chart

DESIGNED for ready reference, a new tube tester is equipped with a special, rotating chart that makes it easy to look up the characteristics and specifications of the tube being tested. Replacing the individual instruction cards now used, the new chart cannot be lost, and gives the data on all common tubes at a twist of a knob. The dial is easily replaced when the introduction of new tubes makes it obsolete.



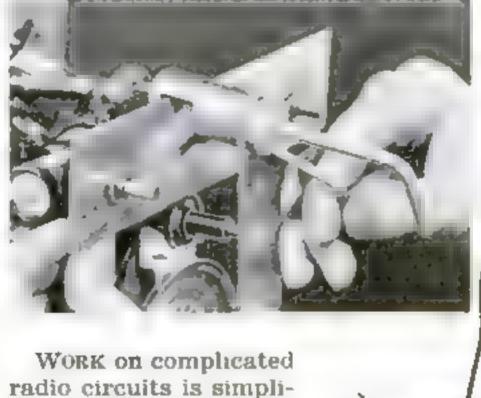
Turning the knob at the right rotates the dial to give the tube specifications desired



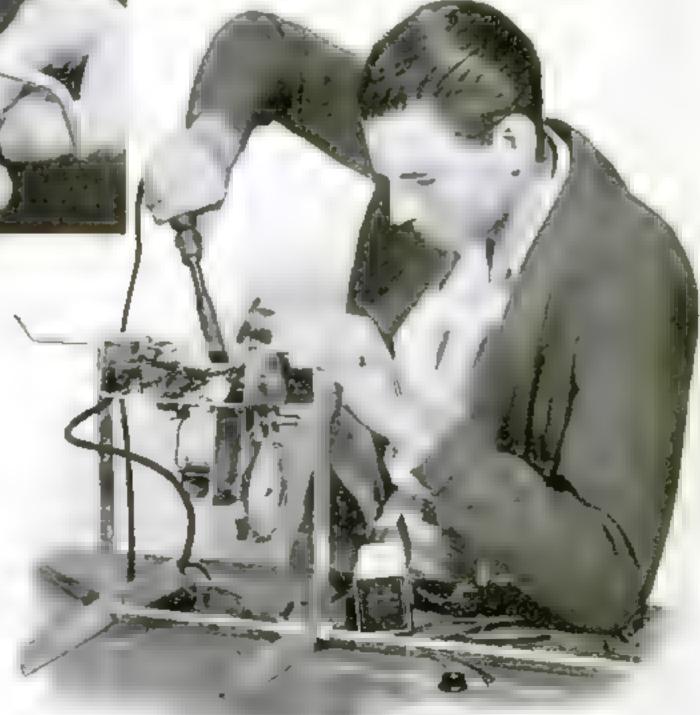
Novel Power Indicators for Radio Transmitters

Novel tuning "wands" now available simplify the problem of adjusting amateur transmitters. Consisting of glass neon tubes supported on metal brackets for panel mounting, as shown above, the indicators show accurately when a transmitter is tuned to resonance. Picking up power from the radio-frequency portion of the circuit, the tubes glow and indicate by their brightness the tuning adjustment that is providing maximum power. They also can be used as efficient modulation indicators.

Stand Holds Chassis for Wiring



fied by a new swinging cradle intended for repairmen and amateur set builders. Two uprights, adjustable to the width of the receiver, carry pivoted clamps that grip the edges of the chassis firmly. The chassis then may be turned to any angle and locked in place, making it possible to work on any part of the circuit easily without injuring delicate parts.



Circuit wiring is greatly simplified by

the adjustable chassis craale. The clamps

that hold the radio are shown at the left

Novel "X" Band Receiver

EASILY MADE FROM STANDARD PARTS

ECAUSE few small home-built receivers cover the so-called "X" band where government weather reports, airway radio beacons, and ship distress calls are heard, many radio fans miss some of the most thrilling wave lengths on the air. The simple receiver shown covers this band as well as the regular broadcast band. With a flip of a switch, it can be transformed from an ordinary broadcast set into a long-wave outfit that will bring in stations up to 1,200 meters.

Although basically, the circuit is a simple regenerative hook-up, it gives constant regeneration over a wide range of tuning, making it possible to adjust the receiver at maximum sensitivity

and slide from one station to another with an ease approaching that of an expensive superheterodyne.

As shown in the diagram, two new-type metal tubes are used. A 6J7 functions as the regenerative detector, while a 6F6 serves as a high-gain, audio-frequency amplifier. To obtain the necessary feedback, the cathode of the 6J7 detector is tapped across a .0002-micro-farad condenser. Two additional condensers, each having a capacity of .00004 microfarads, are connected in series across the cathode and grid. This arrangement allows greater flexibility in coupling the antenna into the circuit. When maximum pick-up is desired, the antenna can be connected through the

jack J_i; for maximum selectivity, jack J_i can be used. In either case, antenna lengths of from ten to fifty feet will prove satisfactory.

Despite the wide adaptability of the set, the circuit is easily wired and the homemade parts are simple to construct. This applies particularly to the coil. Unlike the units used in most dual-band receivers, the single tuning inductance shown consists simply of 360 turns of No. 32 enamel-covered copper wire wound on a one and one quarter inch diameter composition form, with a single tap placed 280 turns from the bottom end. A sixty-millihenry, latticewound, radio-frequency choke is used across the condenser Cz, and a singlepole, single-throw toggle switch connects the bottom of the coil winding to the tap. When the switch is closed, the bottom portion of the coil is shorted out and the tuning range covers the broadcast band from about 610 to 1650 kilocycles. When the switch is open, the full length of the coil is used and the 250 to 630-kilocycle range is covered.

There is just one precaution in assembling the tuning circuit. If the .000365-microfarad tuning condenser is provided with a trimmer, make sure that the latter is adjusted to its wide-open position. If left closed, the change in capacity will tend to limit the overall frequency range of the circuit.



Three controls and two pairs of jacks are mounted on the aluminum panel

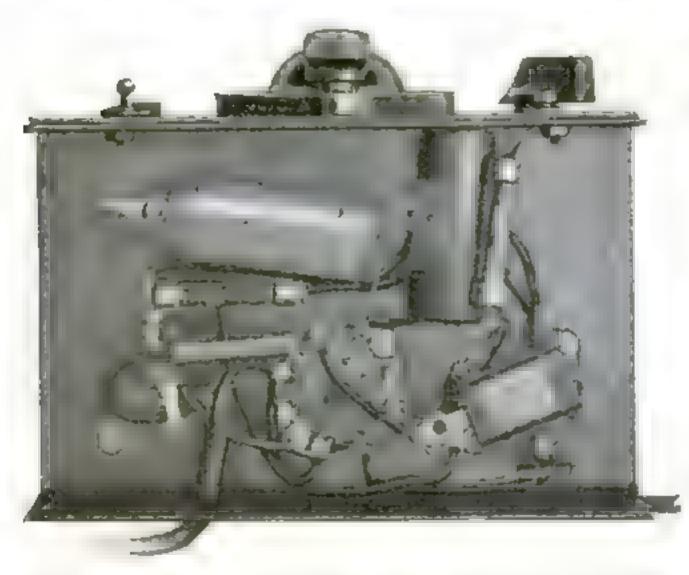
As for the hook-up, the set is wired like any small receiver. Make the con-

nections to the sockets, coil, and other large parts first, then it will be easier to wire the small resistors and condensers.

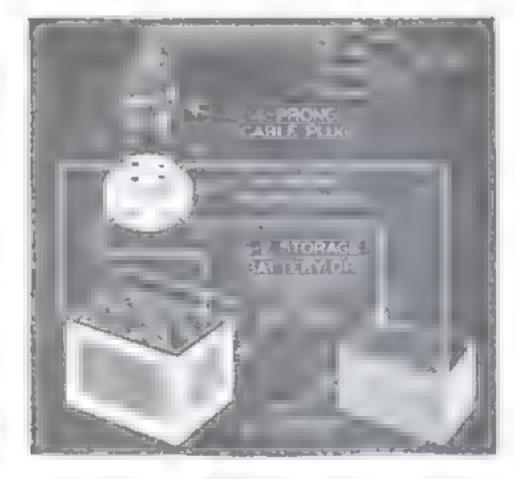
Like the coil, the receiver's power supply is reduced to the simplest terms. For the plate circuit, a single fortyfive-volt "B" battery will provide more than enough power for headphone use, while a six-volt storage battery, or four dry cells connected in series, serves as the filament supply. Incidentally, the receiver will operate efficiently on "B" voltages as low as ten or twelve volts. Also, if a 6C5 tube is substituted for the 6F6 tube, the filament current consumption can be reduced approximately forty percent—an important consideration from the standpoint of economy if dry cells are used. This tube change can be made merely by substituting one



A rear view of the set, showing the tubes and tuning coil



The small parts are mounted under the chassis to simplify the connections to the two tube sackets and the coil

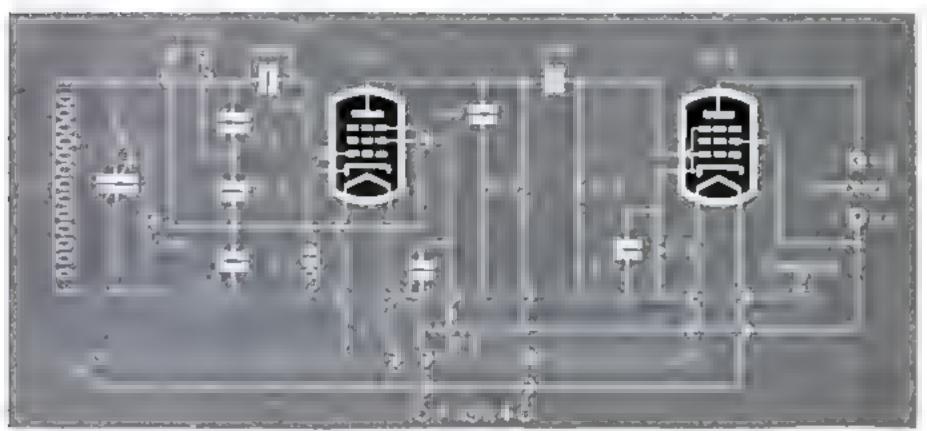


How connections to the battery supply can be made with a four-prong plug and cable

This Inexpensive Dual-Wave Set Brings in the Airway Radio Beacons, Government Weather Reports, and Ship Distress Calls As Well As Regular Broadcast Stations

Ву





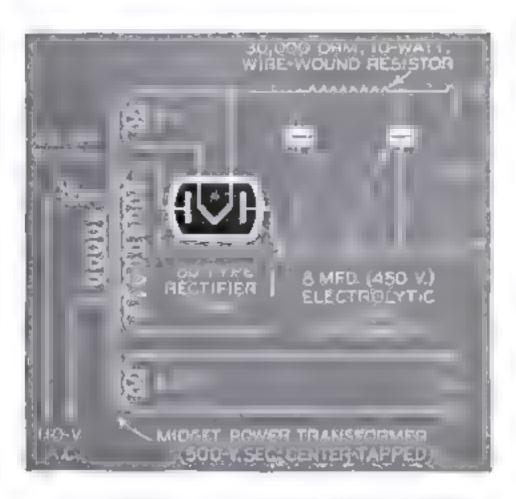
At left, wiring diagram for the simple, twotube circuit. The parts, listed below, are few in number, and can be purchased at low cost

cuit alteration being necessary.

If a regular 110-volt, alternatingcurrent supply is desired, the simplified circuit shown in the diagrams, or any similar circuit delivering six milliamperes at forty-five volts and one ampere at six volts, can be used. In either case, however, the power connections will be greatly simplified if the receiver is provided with a four-prong plug and cable.

When using a house-current supply, a 110-volt switch should be placed in the alternating-current line. If batteries are employed, the cable connector can be used to disconnect the batteries and the switch can be omitted.

In constructing the 11/2 by 41/2 by 7inch chassis and the 7 by 7%-inch panel, I used No. 16 gauge sheet aluminum. If sheet iron is used, No. 18



For operation on a 110-volt house-lighting circuit, the power supply above can be used

tube for the other in the socket, no cir- gauge metal will serve adequately. As shown in the photographs, the tubes, choke, and coil are mounted above the chassis, the small resistors and condensers under the chassis, and the tuning condenser, regeneration control, and switch on the panel.

R33 XYZ

1538 KL1 195

In using the receiver on the "X" band, it will not be difficult to locate the government weather reports and commercial stations. The airways radio beacons can be easily recognized by a single-tone audio note. If you happen to be located "on course," between two airports, this tone will be continuous. However, if your receiver is located to one side or the other, which is more likely, the letter "a" (dot dash) or the letter "n" (dash dot) will be heard in code. Which letter you hear will depend on which side of the course you are located. At the end of each minute, there will be a short period of silence followed by one or two letters in code. These letters identify the home airport where the radio beacon is located. Regularly, on schedule, weather reports in voice will be given. The weather reports differ from the reports usually heard in that they give actual on-thespot descriptions of the weather conditions at the airports along the airline.

Lighthouse radio beacons can be recognized by the repetition of one letter in code repeated for intervals of one minute each. Usually, three stations in three different locations will transmit in sequence so that a ship can take radio compass bearings on each and determine its position.

In common with all receivers having a regenerative circuit, this set is cap-

WHAT YOU WILL NEED

C₁. -Variable condenser, .000365 mfd.

C₂.—Fixed condenser, mica, .0002 mfd.

C₃.—Fixed condenser, mica, .00004 mfd. C₁.—Fixed condenser, mica, .0001 mfd,

C₅—By-pass condenser, paper, 1 mfd.,

200 volt. C4 -- Coupling condenser, paper, .01 mfd.,

400 volt.

C: -By-pass condenser, electrolytic, 10

mfd., 25 volt. R₁.—Resistor, metallized, 2 megohm, ½

watt

R₂.—Potentiometer, 50,000 ohm.

R₂.—Resistor, metallized, .25 megohm, 1 watt.

R.—Resistor, metallized, 1 megohm, ½

R:.-Resistor, metallized, 400 ohm, 1

watt.

L.-Tuning coil (see text). L2.—Radio-frequency choke, 60 mh.

Sw.—Toggle switch, single-pole, single-

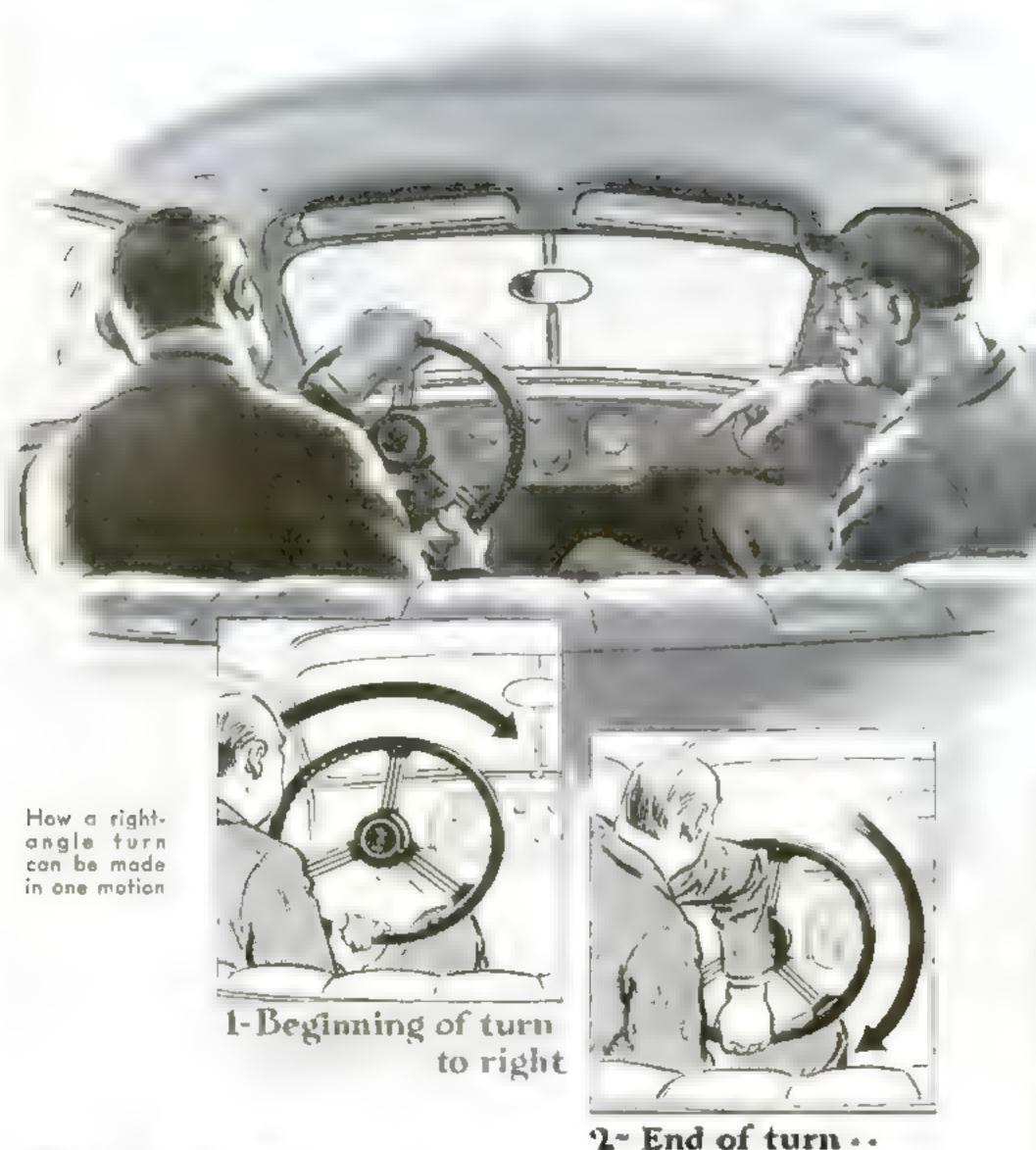
throw.

J₁ and J₂—Insulated jacks for antenna. J₁ and J₄.—Insulated jacks for ear-

phones.

Miscellaneous.—Chassis, panel, sockets, tubes, wire, nuts, screws, solder, dial, lugs, knobs, etc.

able of interfering with other nearby receivers if it is improperly tuned. When tuning past stations, the set may oscillate and give the familiar "peanut whistle" effect, which will be heard in any other receivers in the vicinity. However, this annoyance can be kept to a minimum if the operator will tune the set from edge to edge of a signal, and back down the regeneration until there is no tendency to whistle, then tune exactly to the center of the carrier wave.



GUS gives

A GOOD STEER ON STEERING

US WILSON, part owner and chief mechanic of the Model Garage, was in the cellar with his partner, Joe Clark, discussing some proposed changes in the racks for storing new tires.

"Seems to me, Joe—" Gus was saying, when a familiar creaking in the beams over his head interrupted him. The rumble told Gus that a customer's car had just rolled onto the main floor. He headed for the stairs, but before he reached them there came a final, protesting creak from the beams as the brakes on the incoming car were jammed on with vicious force, and a voice like the bellow of a bull shouted an earsplitting, "Hey, Gus!"

"Hello, Tim," Gus grunted to the huge, heavy-set man who was climbing out of his brand new sedan. "What's eating you today? Have you pushed one of the pedals through the floor boards, torn the emergency-brake lever out by the roots, or maybe accidentally ripped a hunk out of the steering wheel?"

"G'wan, Gus, stop kidding," Tim Grogan replied, with a chuckle that shook his barrel-like chest. "I just stopped in to see if you could do anything about this steering gear."

"What seems to be the matter with it?" Gus asked, as he reached through the window and gave the steering wheel an experimental twist.

"Nothing's busted," Grogan explained. "What I'm kicking about is all the motion you have to go through just to turn around a corner and, worse

By MARTIN BUNN

"Lots of fellows make turns like that," Gus commented, "and no wonder they complain about it taking so much motion. Now let me show you just how it ought to be done."

yet, when you have to park the car. Why, when I swing a corner I have to turn that darned steering wheel like I was winding up a music box. It's a nuisance. What's the sense of making a steering wheel that you have to turn so far to make the front wheels do what you want them to? My last car was bad enough, but this is much worse. Why can't they make them like they did in the old days, when all you had to do to go around a right-angle corner was to give the wheel about a quarter turn or so?"

"Well," explained Gus, "one of the reasons why they make steering wheels like they do now is so women can turn them easy—and

you know a lot of women drive, these days. The more you gear down the steering wheel, the more you must turn it to get the front wheels to any given angle—and the easier it moves, too."

"Humph!" Grogan snorted disgustedly. "Just a lot of sissy automobiles. That's what they're turning out, these days. Made for women, and for men with jelly in their arms instead of muscles!"

Gus grinned. "Too bad we can't all be regular Samsons like you! Seriously, though, there are other reasons for the low gearing of steering wheels. I'll bet even you wouldn't like to handle a modern car if it had the quick-action effect you talk about. You've got to remember two things. First, it really takes a lot more power to turn the front wheels of a modern car than it used to, because of the big tires all cars use nowadays. I grant you that steering in ordinary driving would call for only a little more pull on the wheel if you had an old-time steering-gear ratio, but I'll bet that with all the muscle you've got, you wouldn't find it any too easy to park such a car in a small spaceespecially if the tires happened to be a trifle soft. And a man with just ordinary muscles would feel like he'd been through a wrestling match by the time he got front and rear wheels against the curb.

"Then there's another point to be considered," Gus went on, "and that is the speed cars travel now. In the days when they used quick-acting steering gears, thirty miles an hour was fast and forty or fifty was going like the devil. At high speed, a quick-acting steering gear calls for a lot of skill—especially if the road isn't any too smooth. A dub is quite likely to wobble all over the place with such a combination.

"Aside from that," Gus continued, warming up to his subject, "think what would happen to the average man if he had a quick- (Continued on page 133)

THE HOME WORKSHOP



of holes as shown in Figs. 1 and 2 of the drawings on the following page. Cut a 1¼-in. hole in the center of the top-

piece, and a 3½-in. hole in the bottom piece.

Cut eight sections of %-in. wood dowel, 7 in. long, and beginning 1/2 in. from one end, make saw slots in each section about 1/32 in. deep and 1/8 in. apart to within 5/8 in. of the opposite end. Glue the dowel sections and circular ends together so that the slots are toward the outer edge. Provide two screw terminals in the top circular section. Paint the cage with insulating varnish or shellac.

In winding the cage, any size bare iron, brass, or copper wire from No. 18 to 26 gauge may be used, although brass and copper are to be preferred.

Secure one end of the wire to the bottom end of one of the notched rods; then, by skipping every other notch, wind the wire to the top and fasten it under one of the terminal screws. Secure another wire to the same rod at the bottom, taking care that it does not touch the first wire, and carry the wire through the remaining notches to the other terminal screw. Under no circumstances should the two wires touch each other.

Fasten a lamp socket to the top wood

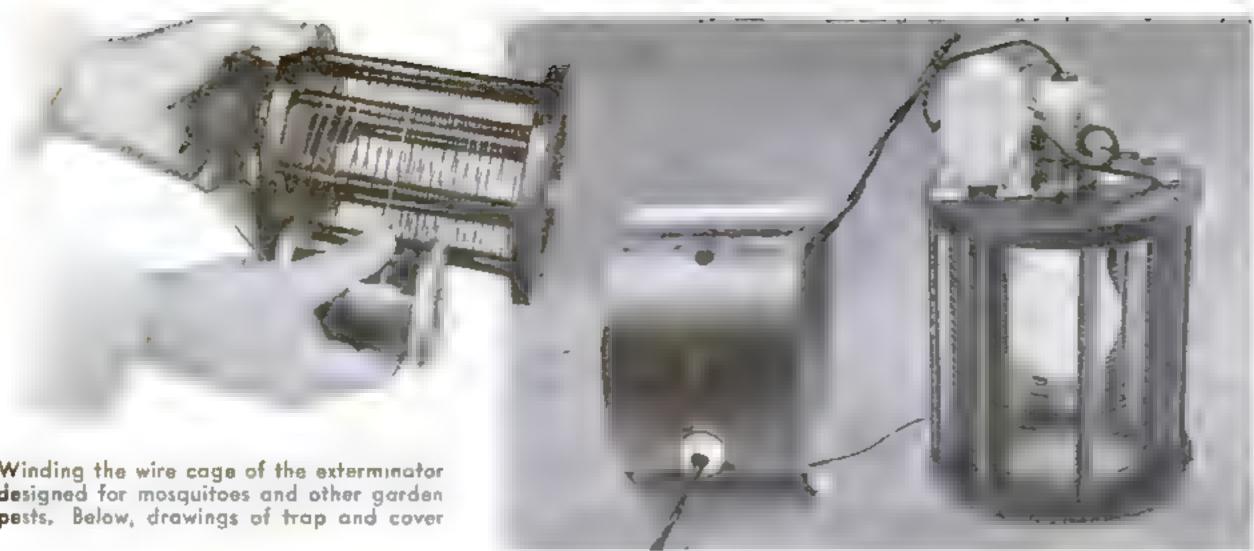
section by soldering to small metal angles, as in Fig. 3. Mount an ordinary bell transformer with an 8- or 10-volt secondary adjacent to the socket, and connect the transformer and socket, as in Fig. 5. It will be noted that the original secondary winding of the transformer is to be connected to the lighting line through the 100-watt lamp, while what was intended to be the primary winding now serves as the highvoltage secondary. With this arrangement it is possible to get a voltage of

stantly killed. Left,

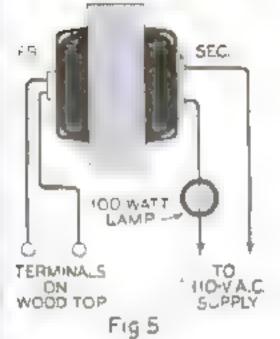
inserting baited

card in electric

fly exterminator



Left, exterminator with cover removed to show how the bell transformer is placed alongside the lamp socket. Connections are indicated below



Winding the wire cage of the exterminator designed for mosquitoes and other garden pests, Below, drawings of trap and cover

32 HOLES FOR 00 00 BOTTOM Fig.1 Fig 2 METAL B-V BELL TRANSFORMER VENTILATING PR LEADS SCREW HOLE DUMET HOR SLOTTED 8" APART FOR GUARD RAILS Fig.3 For Night-Flying Insacts

Build two 8 by 10-in, frames of well-seasoned wood, as shown in Fig. 6, and bolt them together. The cardboard spacer should be about 1/4 in. thick and 1/4 in. wide, so that a piece of cardboard for holding the bait may be inserted between the frames. Cut openings in the bottom of the frame and provide a latch for holding the bait card.

Beginning ¼ in. from the inside end of the frame, saw notches 1/4 in, apart and 1/32 in. deep, to within ¼ in. of the opposite end of the frame. Fasten

> a 314 by 8-in. platform with terminal screws to the top of the frame, as shown in Fig. 7. Paint the frame with insulating varnish or shellac. Secure an end of the winding wire to the lower end of the frame, and wind the wire to the top, filling

> > HOLE FOR

Side View

PORCELAIN

BUSHING

every other slot. Fasten the end to a terminal screw. Begin at the same lower end of the frame, and wind another wire to the top of the frame in the remaining slot, ending at the remaining terminal screw.

Provide two sides of 4-in. plywood, 31/2 by 14 in., and drill holes for four 14-in, wooden guard rods. (For the sake of clearness, only one side is shown in Fig. 7.) Make two metal troughs to catch the dead flies. Place dowels in the holes for guard rods.

A small power transformer such as is used in midget radio sets, with a maximum voltage of 700 volts, is used. Other radio transformers or small neon transformers may be substituted provided the voltage is not over 1,000 volts. As mentioned before, an accidental shock is likely to be unpleasant, although not dangerous. It is advisable, however, to keep the device out of the reach of small children. Provide a metal cover, with hook, porcelain bushing, and ventilating holes, as shown in Fig. 8. For bait, the cardboard that slips in between the frame sections may be coated with syrup or sugar and water, or pieces of meat or other food scraps may be wired to the cardboard.

MOUNT TRANSFORMER

ON THIS PLATFORM

from 200 to 300 volts, depending upon the size of lamp used. Using a 100watt lamp will provide approximately 300 volts. If a higher voltage is desired for special applications, it may be obtained by using the method to be described later.

When the cage has been wired, the outer 4-in. dowel sections may be glued in place to prevent accidental contact with the

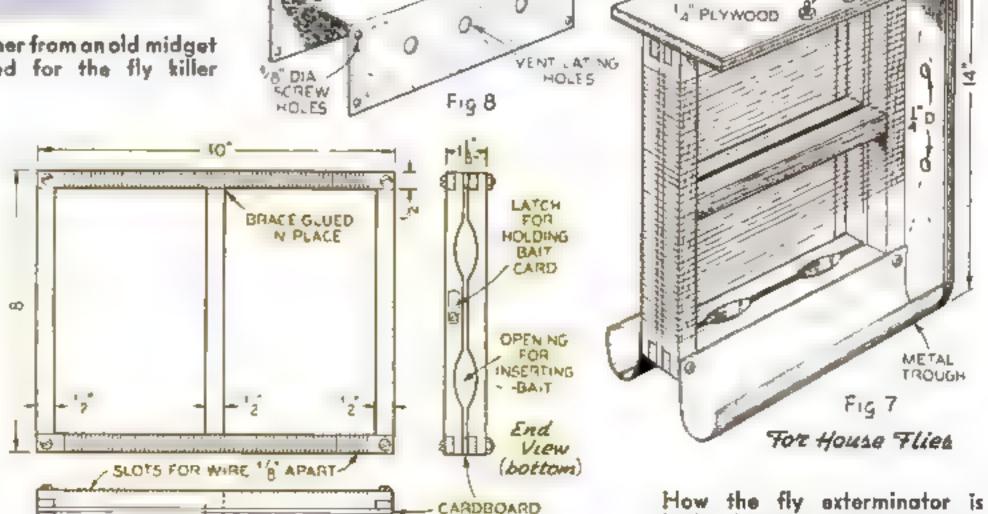
current-carrying wires. While one may receive an unpleasant shock through his fingers, the device is in no sense dangerous. Since the 110-volt line is completely isolated from the cage wires, there is no possibility of one's getting a shock through his body to the ground.

Provide a metal cover with a hook, ventilating holes, and porcelain bushing for the connecting cord, as shown in Fig. 4.

The second type of exterminator is for house flies. It will rid fly-infested locations cleanly and efficiently if suspended in an open space, hung against a door or wall, or even placed flat on a table.



A power transformer from an old midget radio set is used for the fly killer



SPACER

Fig. 6

NO 22 GAUGE

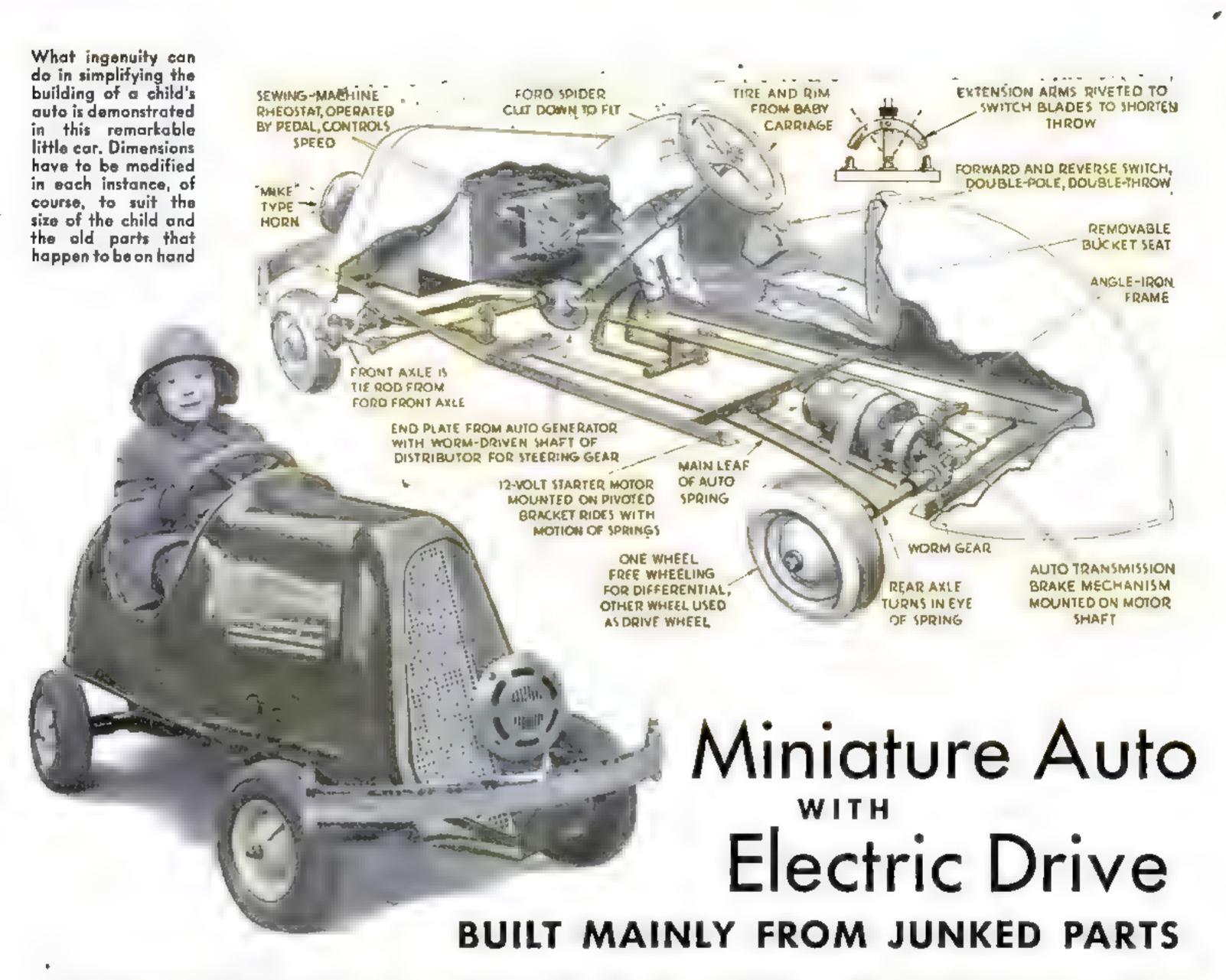
SHEET

ME TAL

built. Instead of a lamp, the

lure is a syrup-smeared card,

which is slipped inside the cage



HOSE readers who have expressed a desire to build miniature autos may find helpful suggestions in the design illustrated. It is a car I built mainly from junked automobile parts for my daughter, who is not yet five years old. She is able to control it perfectly and can apply the brakes or change from a forward to a reverse speed.

The chassis is made from 114-in. angle iron, mounted on two main leaves from old automobile springs. The wheels are a standard type with large tires sold for use on various wheeled toys.

For the front axle I used an old model-T Ford tie rod. This was cut down, and the yokes were attached to both ends. The yokes come with brass bushings in them, and the pins fit snugly. There are oil cups at the top.

The motive power is derived from an old 12-volt Dodge self-starter operated by two 6-volt storage batteries. The drive is worm and gear, the gear being mounted directly on the rear axle. In this way the car is geared to do eight miles an hour.

The speed is controlled by an old sewing-machine rheostat, rewound with nichrome wire so that by moving the lever it is possible to obtain six special from a standstill up to eight miles and hour. The rheostat lever is attached ... a foot pedal, and the farther the pecasion is depressed, the faster the car will go.

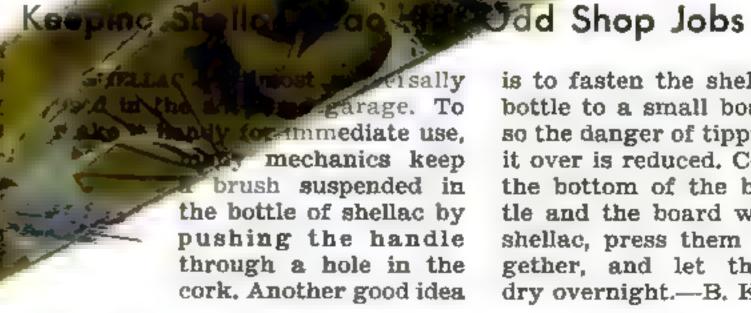
Alongside the accelerator pedal is the brake pedal, which is so arranged that the same foot is used for both, making it impossible to apply the brake while the power is on.

The motor is reversed by means of a double-pole, double-throw switch. With a few minor changes in the switch, it is used as a speed lever.

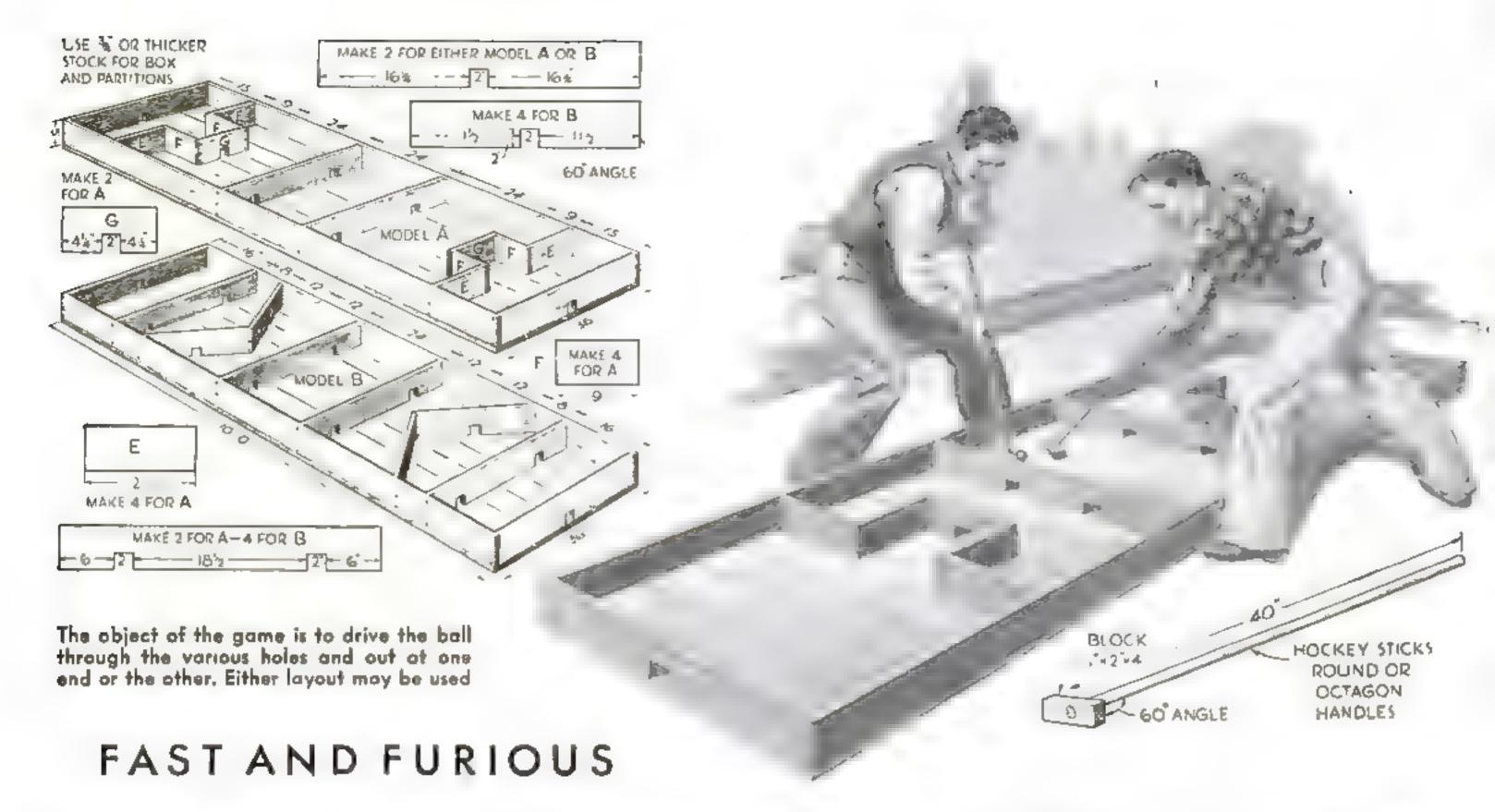
The steering box is of worm-andgear type with a ratio of three and a half to one. This was obtained from an old Buick generator with the ignition unit mounted on it. The head at the commutator end, which contains the worm and gear, was used as the case. The armature shaft serves as the steering post; part of the distributor shaft, as the cross shaft.—IRVING STEINHARDT.

Clothes Hangers Hold **Outdoor Drying Rack**

WHEN small articles of any kind have to be dried in the sun, a convenient rack to hold them may be made by hooking two wire clothes hangers over a clothes line or any similar line and suspending a boardbetween them.-I. M. HOWARD.



is to fasten the shellac bottle to a small board so the danger of tipping it over is reduced. Coat the bottom of the bottle and the board with shellac, press them together, and let them dry overnight.—B. K.



Hockey Game Played in Long Wooden Box

AN EXCITING substitute for hockey can be made as shown from old lumber of any kind strong enough to stand the severe pounding. Two or four players may take part, and the game is equally well suited for indoor use in inclement weather or outdoor use at camps or playgrounds or in any back yard.

The dimensions may be changed for the most part so as to suit the material at hand, though the width should not be more than 3 ft. The longer the game box, the more lively the scrimmage. If grown men are to play the game, the partitions will have to be made from 2-in, thick stock. A broom handle makes a good stick, with a block of maple or oak for the head. The angle for the head is usually from 45 to 60 deg. A hole is bored in the head, and the handle is glued on very tightly.

The hockey ball should be about the size of a golf ball; in fact, a golf ball may be used, though something harder is to be preferred because a golf ball is inclined to bounce too freely. A small iron ball is better.

After the ball has been placed in the center of the middle compartment, the contestants start with "hockey one, hockey two, hockey three, play!" They tap their sticks together between each

statement. At the third tap, the ball is in play, and the fun begins. The object is to take the ball as quickly as possible out through the small holes to the goal.

Only a few rules are needed. Holes should not be blocked with the stick, and the ball must not be held tightly in the corners. If the ball is knocked out of the box, it should go back in play at the point where it left the playing field, and the same starting process is used as at the beginning of the game. Players should not step into the box, but should stand on the floor or ground outside at all times. If the game is found too strenuous for two contestants, four can play.—R. H.

Sunflower Toothpick Holder

TOOTHPICKS for spearing olives, cocktail sausages, and other appetizers may be served much more attractively and conveniently than usual by making a metal holder of the type illustrated. It is designed to give a sunflower effect.

The material used for this particular model was neckel-plated zinc, but any suitable metal will serve the purpose Cut a 2½-in. disk for the base and to it solder the stem (3/16 by 5½ in.) and two leaves, which are the and 4¼ in. long respectively. Two

disks, each 114
in, in diameter, are soldered together and to the stem for holding the toothpicks. If you wish, the lattenhang of of the olorest variety.

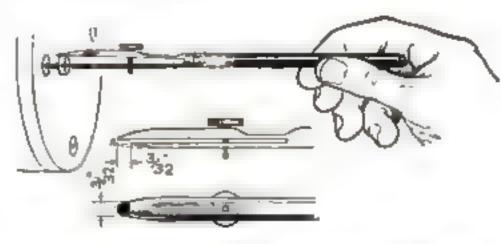
Fortingly boothpicks out.

Orest variety.

Orest parorehand by diaming them

in-dres- K. M.

approximate the second second



Remodeled Drafting Pen Drives Tiny Screws

For starting and driving very small machine and wood screws in clocks, cameras, small motors, and the like, an excellent tool may be made from a discarded draftsman's ruling pen or an inexpensive new pen.

The points are filed down until they are about 3/32 in. in width, and the immovable blade is filed still more, until 3/32 in. shorter than the other blade. Both are then beveled from the side. In use, the short blade is placed in the siot, and the longer one tightened against the outside of the screw head as shown above.—James W. Wyatt.

Made of metal, this

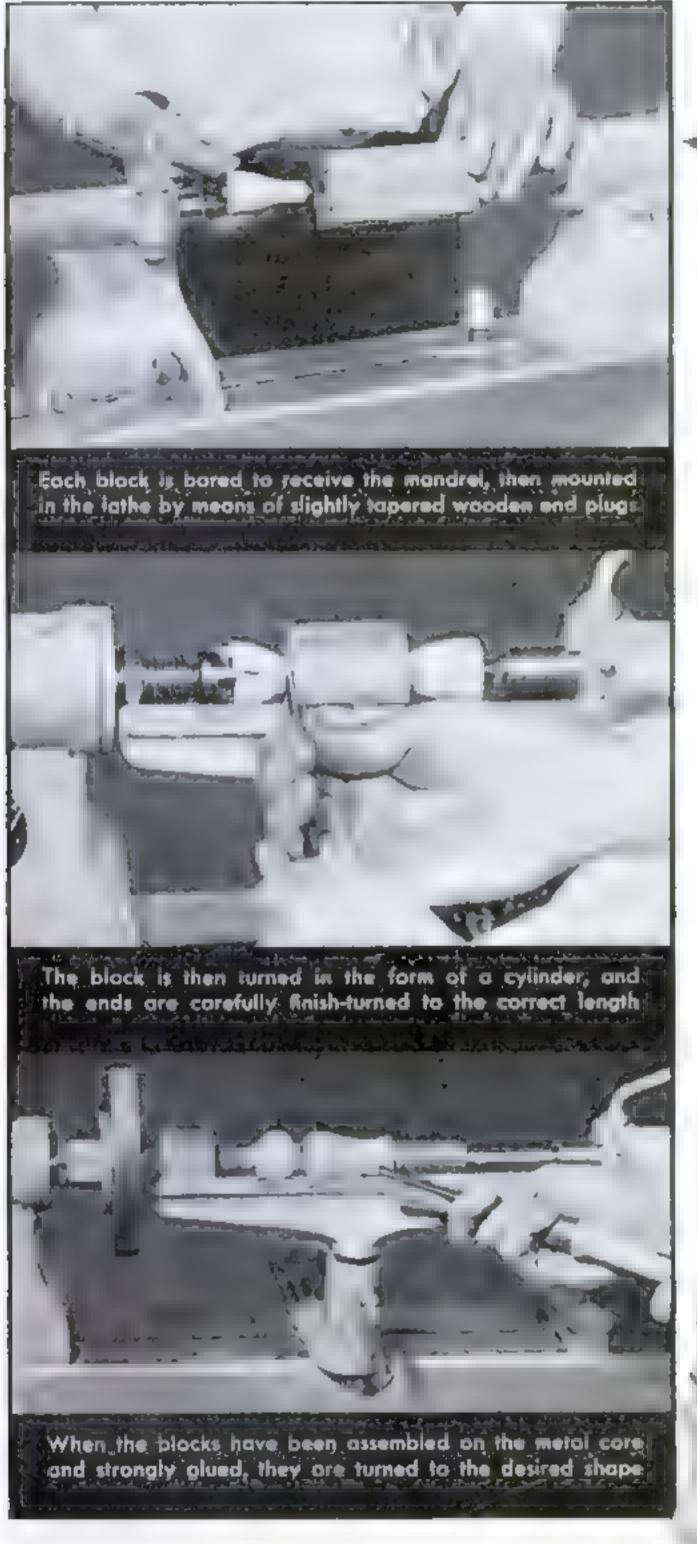
tray or table novelty

is designed to hold

colored toothpicks

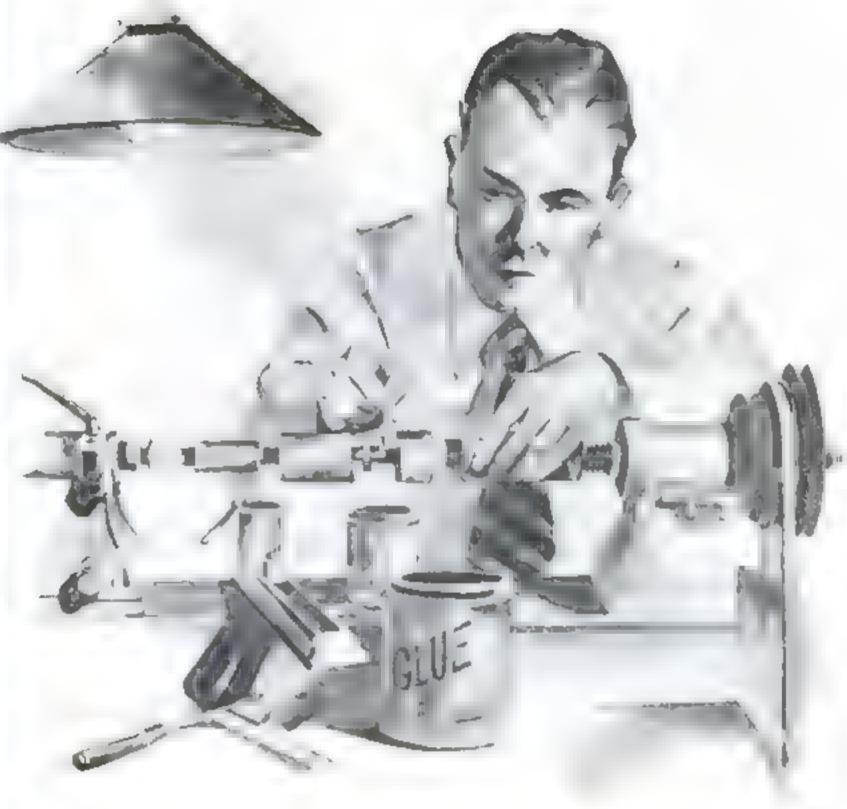
METAL CORE STRENGTHENS STOCK FOR

Thin Built-up Turnings



UTLT-UP turnings of colored woods usually give the woodworker considerable trouble. This is especially true of long, thin turnings for candlesticks and lamp bases. If made in the regular way, the article lacks strength and is very difficult to drill lengthwise without breaking the joints or splitting the turning.

With the method shown, all this is avoided. The various pieces are assembled on a mandrel of steel rod or brass tubing, which acts as a core. For turnings that require a hole through the center, tubing is used; for



To avoid the usual difficulties of making thin turnings, a number of blocks are glued together on a steel rad or a piece of brass tubing

other turnings, the steel rod is better. The size of the core depends upon the diameter of the finished article, although it is best to avoid too small a rod because of the possi-

bility that the turning may "spring." The wood may be turned down to reveal the core at one or more places along the piece, if desired. When the exposed metal is polished, it forms a decorative contrasting band or bands.

The pieces of wood selected for making the project are first sawed to shape and cut slightly longer than necessary. A hole the size of the core is drilled lengthwise through each piece. End plugs are fitted in the hole to center and hold these blocks in the lathe. The plugs are easily made by turning a cylinder of wood

The finished lamp standard is very strong because of its metal backbone and tapering it towards the center in each direction to a size slightly less than that of the core. It is then cut in two.

The outside of the blocks is rough-turned to form cylinders, and the ends are finish-turned to the required length. These ends should be at perfect right angles to the hole in the center.

The core should then be centered in the lathe. If the article is to be a lamp base, one end of the core may be let into a hole in the faceplace turning. End plugs may be used as in turning the wooden blocks. The brass tube shown happened to be of the same size as the shoulder of the dead center so the writer was able to hold it with that

in assembling the blocks on the core, any high-grade glue may be used, the glue being applied to the metal as well as the wood. The assembly should be tightly clamped, but care should be used not to spring the work out of line. When the glue is dry, the piece is ready to be turned to its final shape. As all the rough turning has already been completed, there should be little strain on the work, which may be shaped down as small as desired, yet still maintain its strength.-Howard R. HEYDORF

LIGHT CRAFTWORK



Comical Jig-Sawed Birds Bob Their Heads in the Breeze

Designs for cutting heads and bodies from lumber 34 in. thick

HESE bird novelties add a touch of color to the garden and an element of humor as well, because their heads wave back and forth in the breeze.

Lumber ¾ in. thick from the ends of apple or other boxes does nicely for the body and head. The work can be done on a jig saw or by hand with a coping saw. The colors should be bright. The legs may be wire or dowels.

The neck for the tall birds should be rather long and made of some waste type of spring steel. Worn-out band-saw blades are satisfactory; the teeth can be cut off with a pair of sharp tin snips, and the blade ends inserted in cuts in the body and head. Hack-saw blades, window-shade springs, and even corset stays may be used if the band-saw steel is not easily obtained. Paint the metal parts thoroughly.—R. H. JENKINS.

Portrait Illuminated by Picture-Frame Lamp

A PICTURE-FRAME lamp like that shown at the right takes up no more room than a lamp and shows off a portrait to advantage.

The frame is made from a single block of wainut or other hardwood 2 by 10 by 10 in. First saw it octagon shape, then mount in the lathe for finishing. Turn the molding around the inside of the opening on the front of the frame. Cut the circle out of the back with a parting tool. By careful measuring, the center may be removed in one piece, and the rabbet for holding the picture and glass cut at the same time. When the frame is almost loose from the center, shut off the power, and use a sharp skew chisel or a pocketknife set on the tool rest to cut through the remaining wood.

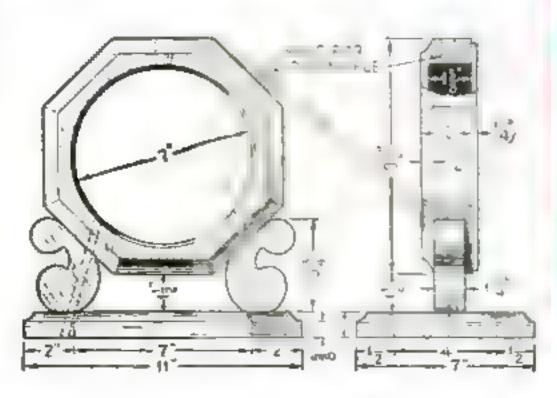
After the base and the frame are finished, mold the edges on either the

The head of the drill need not be reversed if a wood table is used over the steel table. Bore holes for the cord—up through the bracket and out through the center of the frame top—before assembling. Screwthe brackets to the base and frame. Apply a finish of rubbed varnish or lacquer before wiring. Fasten the picture and glass with picture nails, then attach the back panel.



After the molding on the inside of the front of the frame has been cut, the center is removed by cutting from the back as shown above. At right is the completed lamp. Below are the drawings and method of shaping the molding on frame and base







JOBS, TRY MAKING THESE

NOVELTIES

Feathers Decorate Indian Plaque

DECORATED with genuine feathers, this carved Indian head makes a colorful plaque to adorn the wall of a den or recreation room.

The materials are itemized in the accompanying list. When you have obtained them, saw and carve the head as shown. Stain or finish it the natural color of the wood, and insert a short dowel rod to hold the horn.

Glue the thongs and hair to the feather quills, tip the feathers with

horsehair, and tie the feathers as indicated. Cut the leather for the headgear with sufficient allowance to overlap the head for gluing as shown by the dotted line in the side view of the carved head. Cut a hole in the leather to slip over the horn dowel. Bead and attach the feathers as (Continued on page 124)



LIST OF MATERIALS

WOOD

- 1 pc. 5% by 33% by 5-in. gurawood for head.
- 1 pc. 1 by 111/4-in, diameter gumwood for base.
- 1 pc. ½ by ¼ by 1¼-in. gumwood for horn.
- 1 pc. paper-thin veneer 854 in. in diameter for background.
- LEATHER

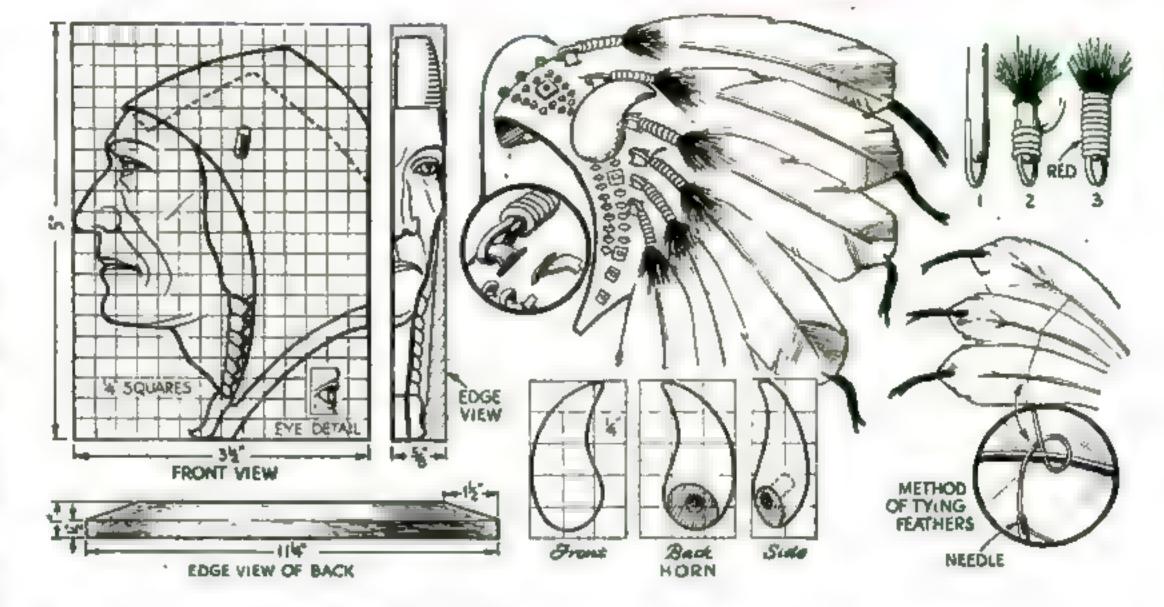
 1 pc. approximately 4 by 6 in. for headgear. This should be thin leather such as that from an old leather jacket, high-top shoes, gloves, or a book cover. A good substitute is felt from a discarded hat. Brown is the best color.
- 6 pc. 1/4 by 1-in, thong, and 1 piece 1/4 by 6 in.

FEATHERS

6 or 7 about 4½ in. long. Wing feathers of the mallard duck are best, but white duck or pigeon feathers may be used.

MISCELLANEOUS

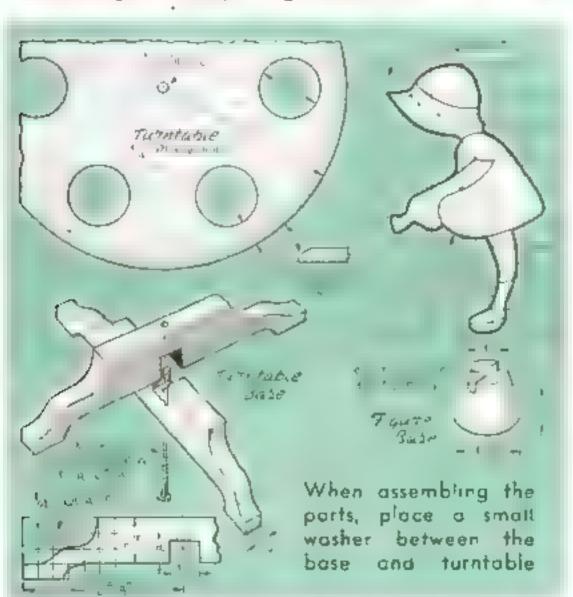
Fur from a squirrel tail or any long animal hair; horsehair. Yellow, red, blue, and white weaving beads. Glue, string for tying feathers, etc.



Drawings for making the plaque. Note in the photograph above how fur is placed under the feathers

Turntable Holds Tiny Cactus Plants

OLORFUL little novelties are always in demand. Here is one that shows a maid watering six midget cactus plants set into holes in a revolving stand. Suitable plants, in variously colored pots, may be purchased.



The base, which consists of two interlocking pieces, is cut from wood ½ by 1 by 5¼ in. Cut a ½ by %-in. dado in the center of each piece; then jig-saw

them. When they are fitted together, a hole should be drilled for a 1%-in. No. 6 blued roundhead wood screw.

The turntable is 14-in, plywood, 6 in, in diameter. The holes are about 1 in, apart, centered 15/16 in, from the edge. A

3/16-in. hole is drilled in the center of the table.

The figure of the girl is cut next, with an individual base slotted to hold her feet. When finished, this base fits on the screw, but it is not screwed down tight because there must be free play for the turntable to revolve. A small washer should be placed between the base and the turntable



so that the latter will revolve easily.

Various color schemes may be used, according to the craftsman's own taste. One suggestion is to have the base a brilliant red, the turntable green, and the figure of the girl red and white, standing on a yellow pedestal. At least two coats of shellac or one of flat white paint should be applied and the whole thoroughly sanded before the colors are added.—W. J. GEE, JR.

Pewter Salt and Pepper Shakers

CALT and pepper shakers are easily made from pewter. They look well on the table and are always welcome as a gift.

The pewter is cast in the form of sticks about 11/4 in. in diameter and 21/2 in. long. A mold is made by boring a shallow hole in a block of wood and setting a piece of cardboard mailing tube or a cylinder of heavy building paper in the hole. Seal the edges with a little putty to prevent the hot metal from coming up on the outside of the tube when the inside is full.

The job can be finished with only one set-up of the lathe if you wish. Chuck the casting by one end, face off the bottom, and true up the outside. The simplest type of shaker is filled from the bottom, so drill or bore out the inside to a diameter of % in. The hole must be counterbored to a diameter of 1 in. for a depth of about 1/4 in, to receive a flat cork.

Polish the turning with 8/0 garnet paper saturated with oil, then with pumice stone and oil applied with a soft cloth. After the shaker has been cut loose from the chucked end of the casting, the remainder of the top may be finished by hand, or it can be rechucked in the lathe, provided the finished surface is protected with a strip of scrap metal be-

tween it and the jaws of the chuck. Finally, the holes in the top are laid out, center punched, and drilled. This may be done on the drill press if you

Left, boring the inside of the shaker with a boring bar

> are careful of the speed, but it is safer to use a hand drill and remove the bit from the hole and clean it when it shows signs of sticking. The holes should be

Above, casting the shakers and, at left, how the holes are made on a drill press

countersunk slightly on the inside to help the pouring of the salt or pepper; they may also be touched very lightly on the outside to remove any trace of burr.

For a more finished job with screw tops, make the shaker in two pieces. Turn, thread, bore, and polish the lower part before cutting it loose. Then chuck and finish the top from the underside, boring and threading it to fit on the bottom. The last step is to drill the shaker holes .- D. C. MARSHALL

Frame Holds Hand Grinder for Use as a Router

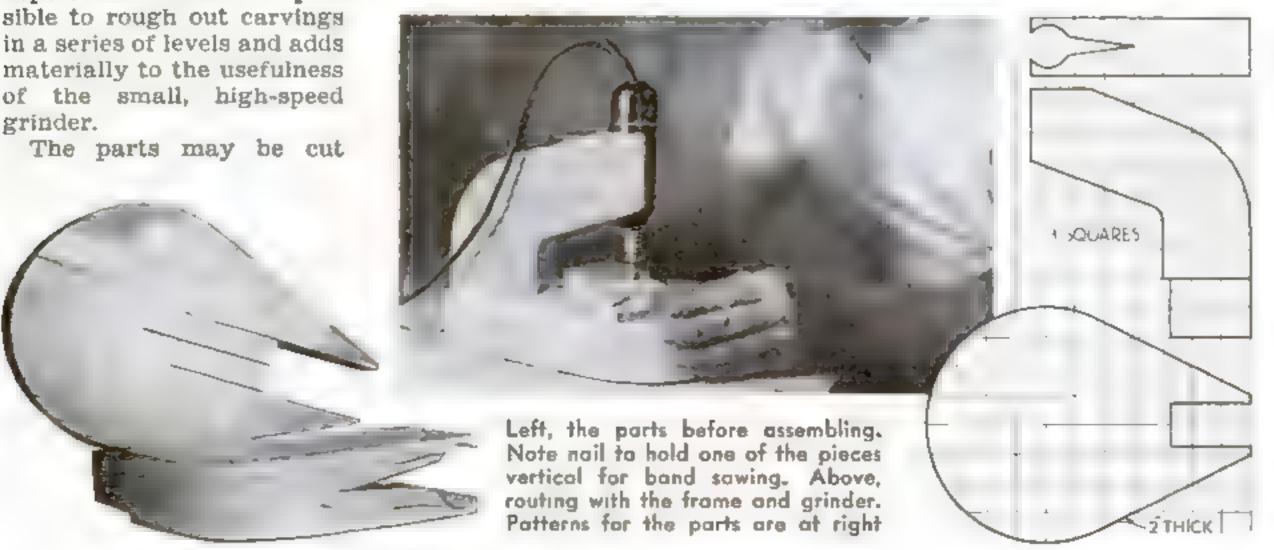
from a piece of wood 2 by 8 by 22 in,

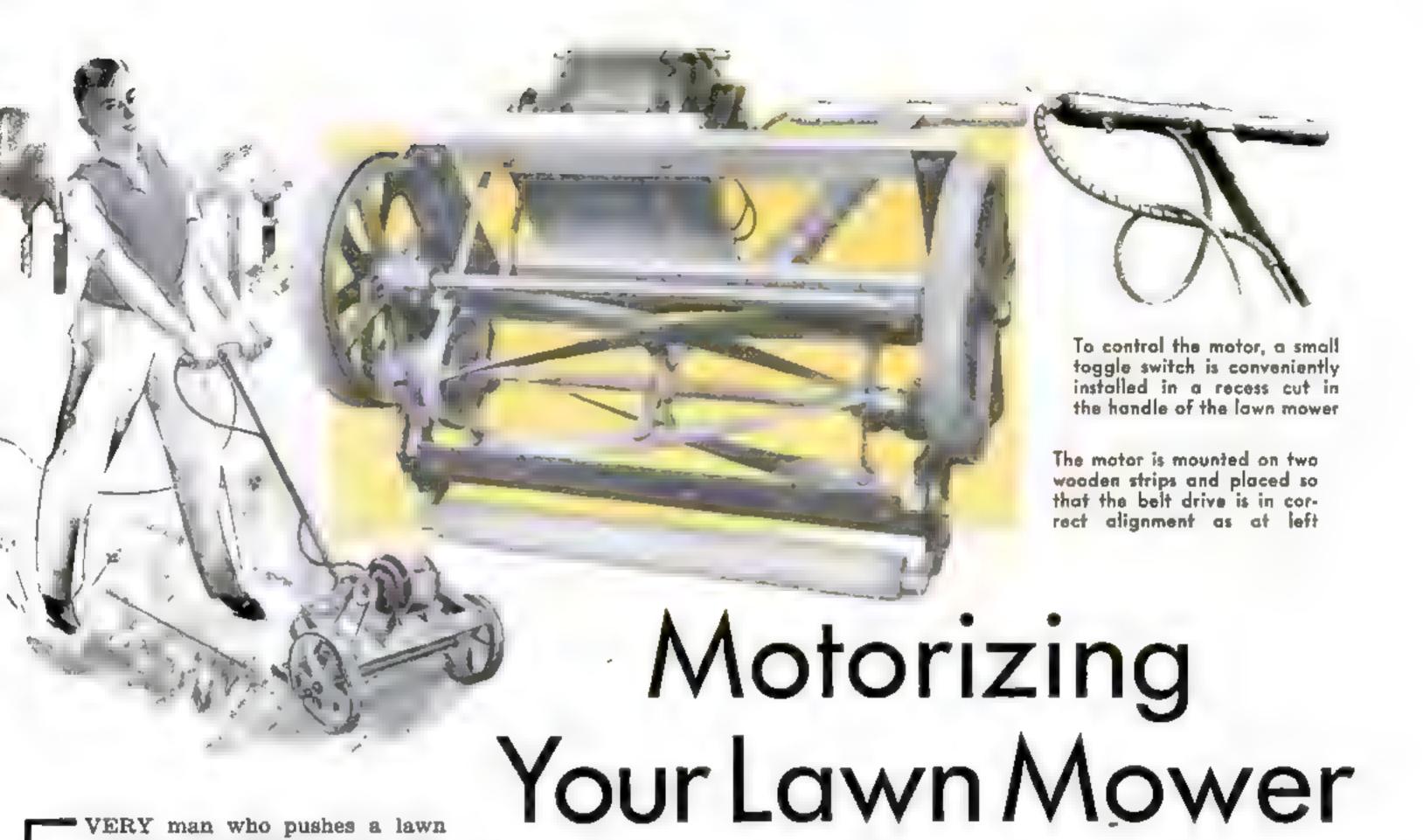
F A FRAME is made as shown, a hand grinder may be mounted so as to rout work accurately to a fixed

depth. This makes it possible to rough out carvings in a series of levels and adds materially to the usefulness of the small, high-speed The head is carefully band-sawed or bored to 1/16 in. less than the diameter of the grinder, then an open throat is cut to allow for the necessary expansion. A nail can be driven temporarily

into the top surface to help keep the piece vertical on the band-saw table and removed later. A screw or bolt with a wing nut may be placed through the throat for clamping the grinder, but if the piece is carefully made 1/16 in. undersize, this will not be necessary.

Sand the parts, glue and nail them together, and finish with shellac or lacquer .- JOHN STEWART WILCOX.





WERY man who pushes a lawn mower has probably looked with longing eyes at the small gasoline engine driven mowers now on the market. If, however, the size of his lawn does not justify purchasing one of these somewhat expensive machines, he can motorize his own lawn mower.

The first requirement is an electric motor, which should be at least 1/6 h.p., but need not have more than a ¼-h.p. rating. A 1,750-r.p.m motor will serve, but if possible try to get a motor rated at 1,140 r.p.m. This will simplify the pulley-drive arrangement.

Remove the cutter rotor from the mower. In most all cases it will be necessary to cut off the inch or so overhang of the blades at one end of the cutter. This may be done with a hack saw. The extra clearance is necessary for mounting the driven pulley. This should be a V-belt pulley from 4 to 5 in. in diameter, with a hole diameter to fit the rotor shaft. The standard hub length of the pulley may have to be reduced in order to fit the space between the end rotor spider and the bearing mounting. The home mechanic will have to work out this part of the construction himself since it depends on his own mower design.

While the lawn mower is still disassembled, fasten two short pieces of angle iron to the inside of the wheel frames, as shown. These provide the mounting for the cross strips that hold the motor.

Reassemble the lawn mower, but omit the pinion drive parts which were previously mounted on the cutter-rotor shaft. These will now be unnecessary. When reassembling the parts, be sure to include the V-belt since this cannot be put in place after the cutter rotor has been fitted into its bearings.

Fasten two wooden strips across the ends of the angle iron supports and mount the drive motor on these in a position to give the correct belt alignment.

The driving V-pulley should be as small as possible (1½ to 2 in.) for the 1,750 r.p.m. motor. The 1,140-r.p.m. motor can use a pulley from 2 to 3 in. in diameter, depending on the driven pulley size. The correct cutter rotor speed should be between 600 and 700 r.p.m.

It is suggested that a control switch be placed at some convenient location on the handle. As shown, the control switch is a small, standard toggle switch set in a recess cut into the handle.

The motor in this equipment turns the cutter, but does not propel the mower. The work of pushing the machine about, however, is very easy, and it is possible to cut readily to the very edge of a lawn, hedge, or any narrow strip.

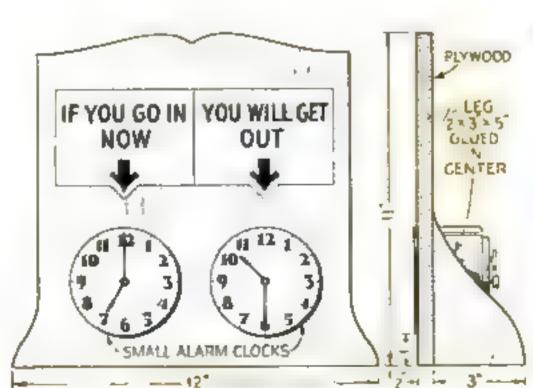
It will be necessary to provide an extension supply cable long enough to reach from the house outlet to the most distant part of the lawn. With a little practice the supply cable will cause no interference.

If, for any reason, the owner ever wants to restore the mower to its original condition, all that is necessary is to assemble the driving pinions on the cutter shaft and slack back on the belt so that it will not turn the motor when pushed by hand.—J. L. BIRD.

Clocks Indicate Length of Show

This automatic box-office informant renders a real service to theater-goers by telling them the time and also informing them at what time they will get out of the show without their having to ask the ticket seller.

Two small alarm clocks of the same make and size are cemented flush in holes in a plywood panel of any desired design, supported by a central leg or brace in the back, as indicated. Paint and decorate the panel, and either letter the legends directly on the painted surface or on a sheet of white Bristol board 3 by 10 in. and paste it in place above the clocks.—E. E. SWANSON.





Suggested method for installing the clocks on the counter of a box office

High-Powered Model Plane

BUILT TO WIN CONTESTS

By FRANK ZAIC

Bend landing gear and wing mount from wire, and cement securely before fuselage is covered. Use several coats of cement.

Wing. After wing outline is drawn full size, make rib template from aluminum, fiber, or Bristol board. Now lay out the leading edge thickness, %-in. at center tapering to 1/4 in. at tips. This tapering spar will give correct leading edge thickness sizes for ribs. The almost uniform trailing edge tapers slightly toward tips, so that 5/32 in. can be assumed for the trailing-edge size of ribs.

First cut upper curve of rib, then measure off the leading-edge size chord of that particular rib, and finally the trailing edge size. Using bottom por-

tion of template, as shown, connect the leading-edge and trailingedge points and cut with sharp razor.

Cement ribs to leading and trailing edges, which are superimposed over the drawing with pins. After cement is set, place the center spars by cutting notches of correct size on center and tip ribs. Connect the two notches with the spar, and cut in the notches on the intervening ribs. sure that the spar is straight. Remove the spar and cut notches to correct depth to take care of the taper- (Continued on page 121)



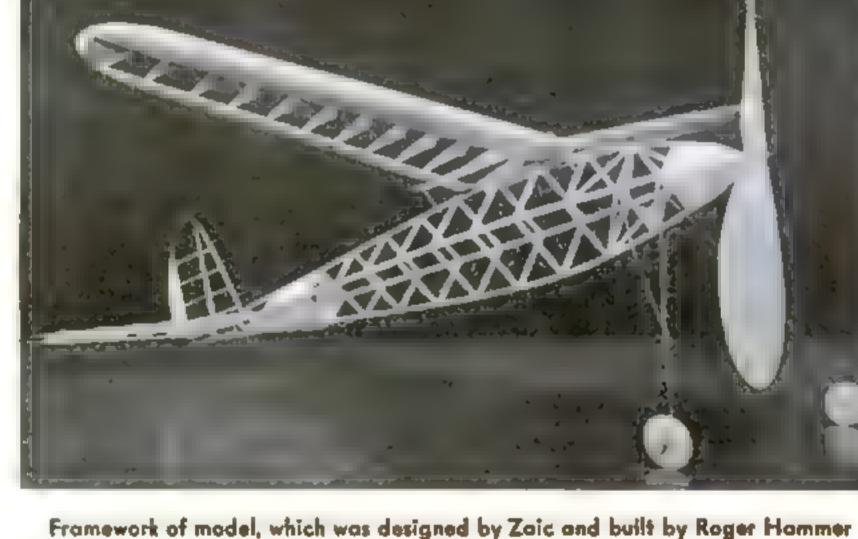
flying model, "Contestant," is in the highaltitude and long-time Designed for class. construction by even the most inexperienced builders, it meets all requirements contest in cross-section, area, and weight.

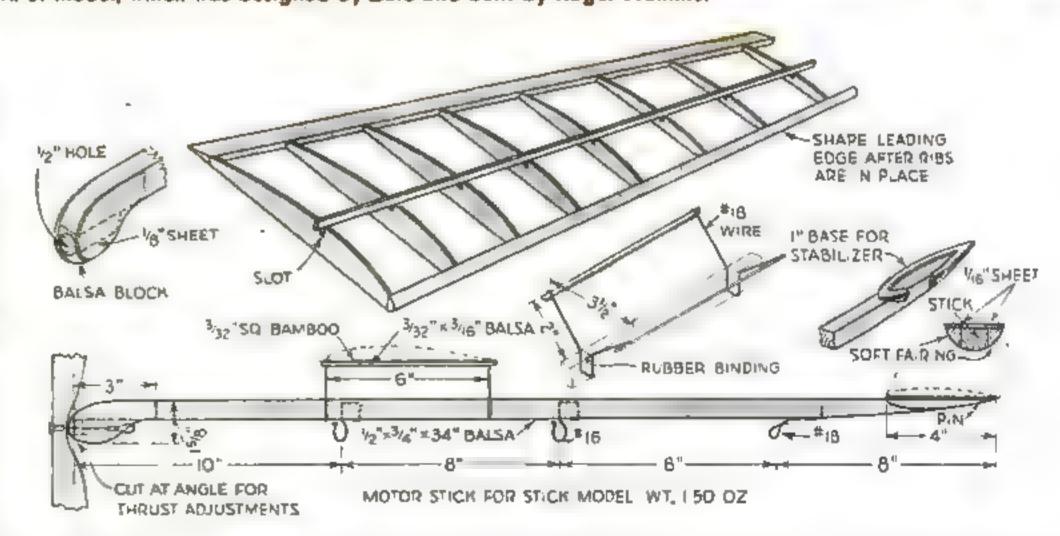
R new modern

Fuselage. Draw fullsize side view-just the outside lines and up-Pin 5/32-in. rights. square longerons over curves. Cut uprights or cross braces by leveling one end to fit the angled longeron; then hold it against inside of upper longeron while the length is marked over the lower longe-While cutting ron. braces, make four of

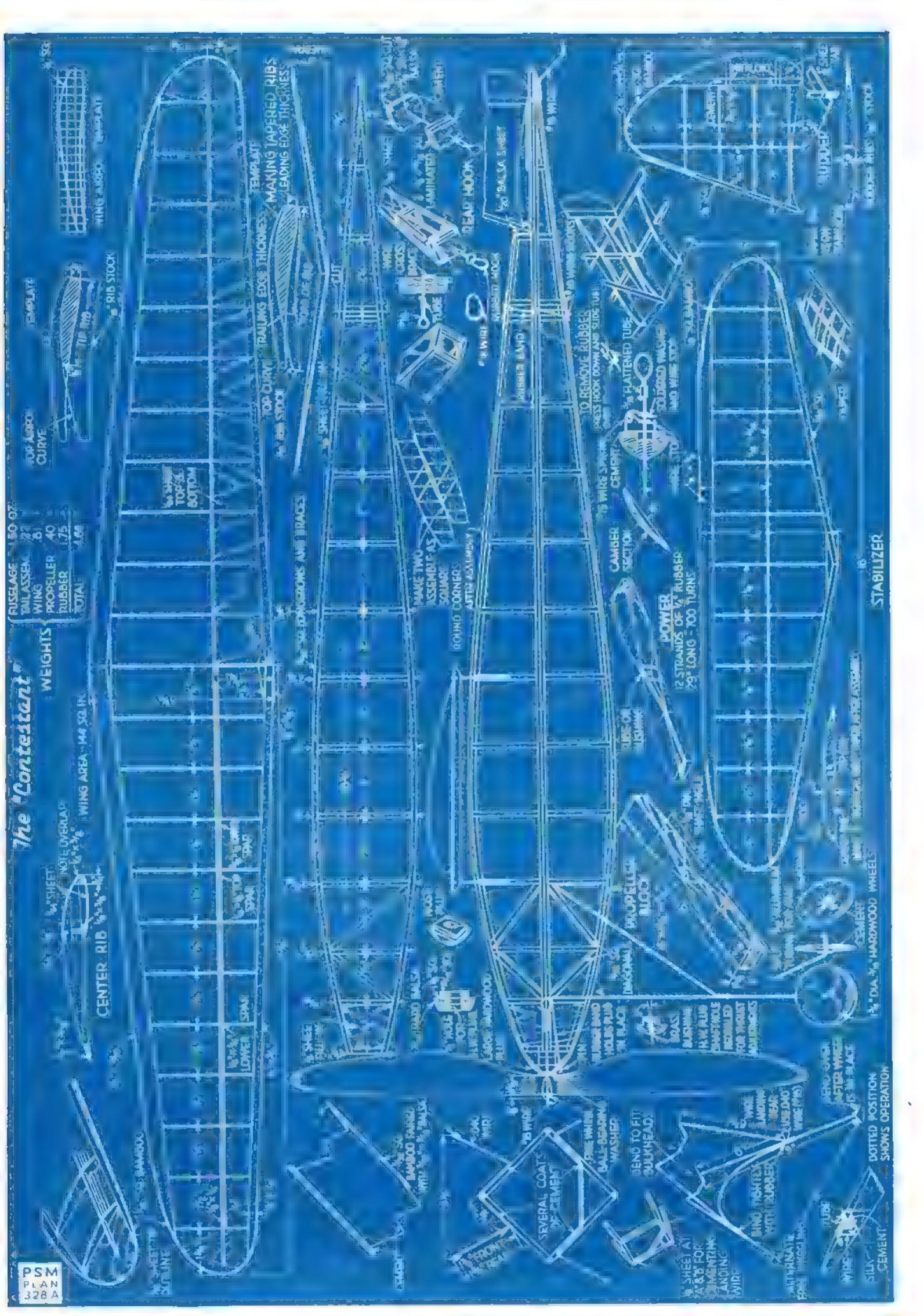
Be generous with cement. each. When dry, remove the complete side from jig and make another. Assemble so that the cross section is square. Cement the fill-in sheets, landing-gear reënforcements, and diagonals. Cut off one longeron in rear as shown and cover the stabilizer rest with sheet balsa. Cut along the "cut" line to separate tail boom from fuselage.

Plugs and landing gear. The hardwood nose plug prevents enlargement of shaft hole, and the angled shaft hole makes a good adjustable thrust-line adjuster. Be sure to have arrow marks to show position of down thrust. Cement both nose and tail plugs well on fuselage.





Sketch of wing assembly and details of the motor stick used when it is desired to convert the fuselage model, shown on facing page, into a stick model, using same wing, tail, and "prop"



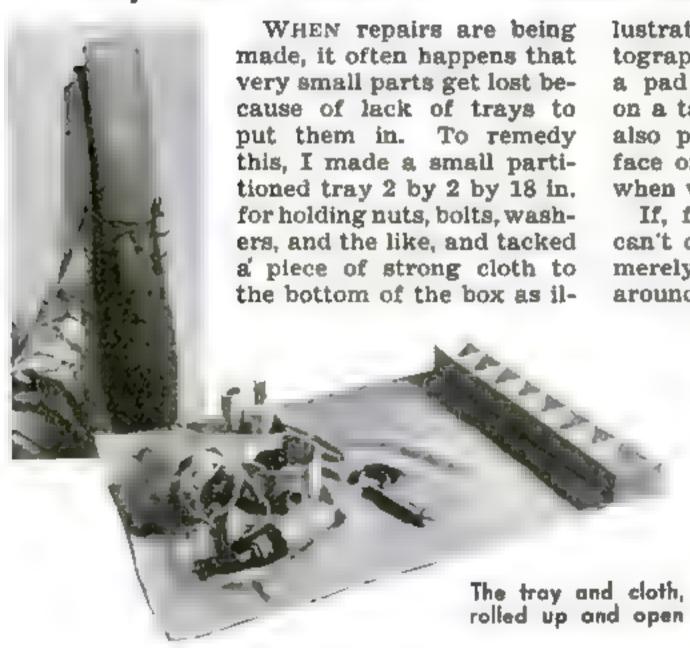


F YOUR lathe can be adapted to turn large pieces, here is an impressive walnut tray for canapés and relishes that can be made in comparatively short time. It was submitted by the Mexico (Mo.) Homeworkshop Club in a recent Guild three-hour project contest (see P.S.M., July '37, p. 82) and won honorable mention.

Glue up the stock from carefully matched walnut, dress one side, saw the piece to the approximate diameter, and glue it to a mounting block with paper between. When dry, fasten the block to the lathe faceplate and turn the piece as indicated. The toothpick holder

A high polish is desirable as it adds much to the beauty of the tray, therefore spare no pains in sandpapering the wood and applying the walnut stain, filler, and preferred finish-shellac, varnish, or clear lacquer.

Tray with Cloth Roll Holds Repair Parts



lustrated in one of the photographs. The cloth acts as a pad when work is done on a table in the house and also provides a clean surface on which to put parts when working on the car.

If, for some reason, you can't complete the job, you merely wrap the cloth around the tray and tie it

> with cord or tape. By this means all the small parts are held in their respective compartments until you are ready to finish the work.

Of course, the tray may be made any size which is convenient for the repairs at hand.



Miniature Photo Displayed on a Guitar-Bridge Easel,

A PLAIN guitar bridge or any small piece of hardwood whittled to approximately the same shape may be used to support a miniature photo. The print, in this case one about $1\frac{1}{2}$ by 2 in., is mounted on a piece of show-card board 1% by 6½ in., cut, bent, and glued as shown above. The cardboard is available in different colors so many arrangements are possible.—D. W. C.

Small Driftwood Float Frees Badly Snagged Fishhook

PROVIDED a stream is flowing rapidly, it is usually possible to release a fishhook or spinner from the bottom by the following method:

Slip a paper clip, or a ring made from an old hook, on the line. With about 2 ft. of string, tie a piece of dry driftwood to the clip and throw the stick well out into the current. Pull the line gently and work the freely running clip down along the line. The water will carry the stick rapidly downstream. If the line is now given a little slack, the stick will pull in the opposite direction, thus loosening the offending book from whatever it was caught upon so that it can be reeled in and retrieved .-- R. H. J.



Cast into the current, the stick floats downstream and helps work the hook loose

Mineral-Oil Barometer

COSTS LITTLE TO MAKE



By Paul R. Rannie

ter that is less expensive and in some ways easier to construct than a mercury barometer, yet accurate enough for amateur weather forecasting and general experimental use. It has a scale three or four times as large as that on a mercury barometer.

A glass tube about \% or 3/16 in. in inside diameter and about 24 in. long is required, as well as a 2-oz. bottle with cork.

Clean and dry the bottle. Make a hole in the cork for the glass tube. Soak the cork in melted paraffin. Pour ordinary mineral oil (such as is sold under various names for medicinal use) into the bottle until there is about 1½ oz. of air (by volume, of course) above the oil if the glass tube is ½ in. in inside diameter. If the tube is larger, the volume of air should be increased.

Clean the tube and dry it by drawing (not blowing) air through it. Push it through the hole in the cork and insert the cork in the bottle. The tube should extend almost to the bottom of the bottle. Run melted paraffin over the cork.

This is now really an "air thermometer." Obtain an ordinary household thermometer and place both it and the air thermometer in a pan or glass of water. Cool them to 50 deg. F. by adding ice to the water. At 50 deg., the top of the oil column should be from

3 to 5 in. above the cork. If too low, blow a few bubbles at a time through the tube and into the bottle. Hold the temperature steady for five or ten minutes so the reading will become constant, and mark it with a string.

Warm the water to 60 deg. and continue by 10-deg. intervals up to 100, marking the tube with string at each step. The oil should rise about 12 in. between 50 and 100 deg. If the oil rises too fast, there is too much air in the bottle, so the cork should be removed and more oil added.

Now complete the barometer as shown. Only the movable temperature scale requires special comment. It is first enameled white, then the gloss is dulled by rubbing it with an eraser so the scale may be inked more easily. The scale may be started at any convenient point, using the distances between the strings as a guide. It is accurate enough to divide each 10-deg. division equally into ten parts.

To make the altitude scale, which goes on the left side of the movable scale, measure the distance between 70 and 82 on the thermometer scale you have just made and let it equal 1 in. of barometric pressure. (The writer determined this proportion by experiment.) Place the 30-in. mark at about the center of the adjustable scale, and lay out the pressure scale below and above it to represent 29 in. and 31 in. Hang the completed barometer indoors and away from drafts or direct heat.

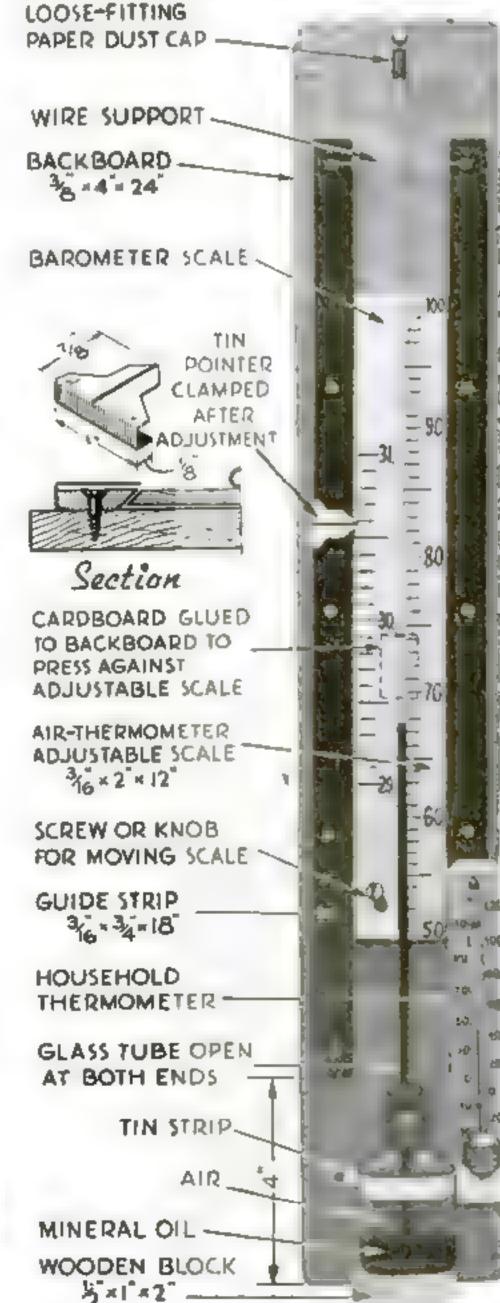
To adjust the instrument, slide the adjustable temperature scale until it reads the same as the ordinary household thermometer. Then you must obtain what is known as the "reduced-to-sea-level" barometric pressure so you can adjust the pointer to its correct permanent place on the pressure scale. You can get this reading from a weather-

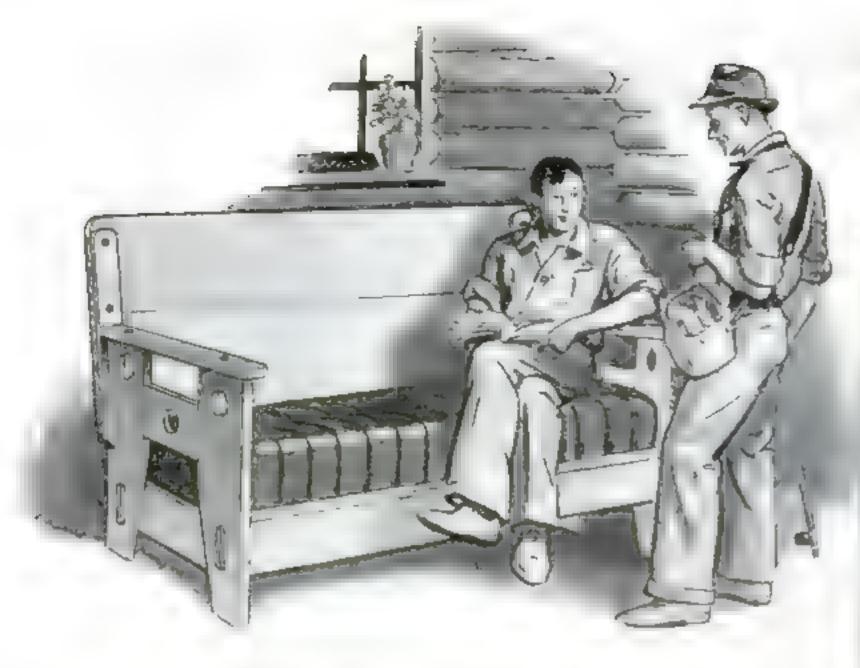
CONSTRUCTION

After the tube of oil has been calibrated to match an ordinary thermometer, as indicated below, it is set up as shown at right

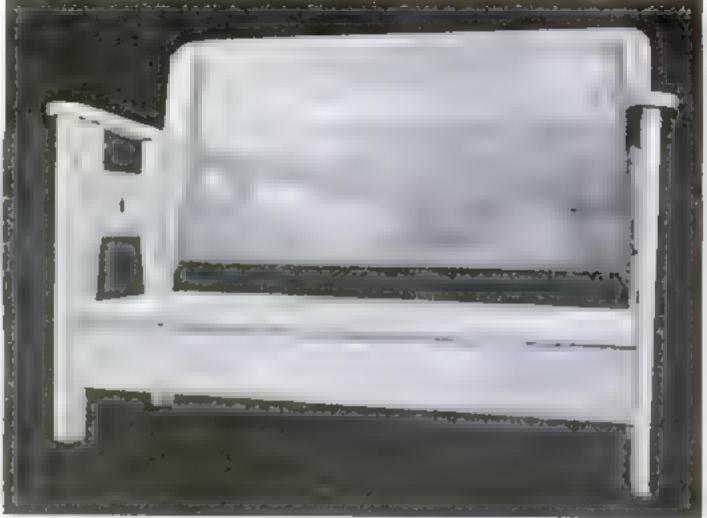
bureau office, if there is one near you, or by listening to radio weather reports. If you cannot get an exact reading, wait until the weather is about average, that is, neither extremely cold or stormy, and set the pointer at 30. You can get the exact reading later on when convenient.

After the pointer on the pressure scale has been adjusted, the barometer is ready to use. Simply slide the adjustable scale so that it reads the same as the regular thermometer, and the pointer will be opposite the barometric pressure. Always note the previous reading before making a new adjustment, because the direction and amount of change is most important. There may be a gradual shift in the pressure readings for a short time after the instrument is constructed, so check the instrument for a few weeks and make any necessary corrections.





Settee Built to Hold an Auto Cushion



The settee ready for finishing. Below, an end view

OR a cabin, country home, or hunting lodge, a sturdy and comfortable settee may be made as shown to utilize an old auto cushion. The dimensions will vary somewhat according to the cushion available, therefore only a few fig-

ures have been given on the drawing to act as a rough guide.

In this case the legs or posts were made of 1%-in. yellow pine, and the remainder from %-in. stock. White pine, fir, cypress, chestnut, or other woods could be used.

After laying out the legs on the 1%-board, bore the 2½-in. holes before sawing the parts; this will help prevent splitting. Use an expansion bit, and bore from one side until the point comes through, then turn the work over and finish boring from the other side. Cut mortises for the tenons of the front and back rails.

Assemble the ends first, and complete the construction as shown. Finishing nails are driven into the posts to intersect the tenons of the rails. The finish may be dark golden-oak stain, walnut, or mission.—Alfred Neuman.

LIST OF MATERIALS

Рc	s. Description	T.	W.	L.
1	Legs	1 8	512	120
2	Rails	78	5 1/2	52 1/2
2	Bottom end rhils	7/8	51/2	18
2 2 2	Upper end rails	, ,	4 -	^
	(doweled)	76	51/2	10
2	Arm rests	3/8	4	22
2 6	Back supports	2/4	3 -	24
6	Back and seat	, ,		
_	bottom	7/8	10	54
8	carriage bolts, 21/2			4 car
Ļi.	riage bolts 3 by 1/4	in : 4	carriae	e holt
	2 by 14 in.; a few 1	12 100	wood	CEPONO
	and a four aightness	72 111	niching	maila
	and a few eightper	my E	шыпп	Harra

Applying Rock Ballast to a Model Railway

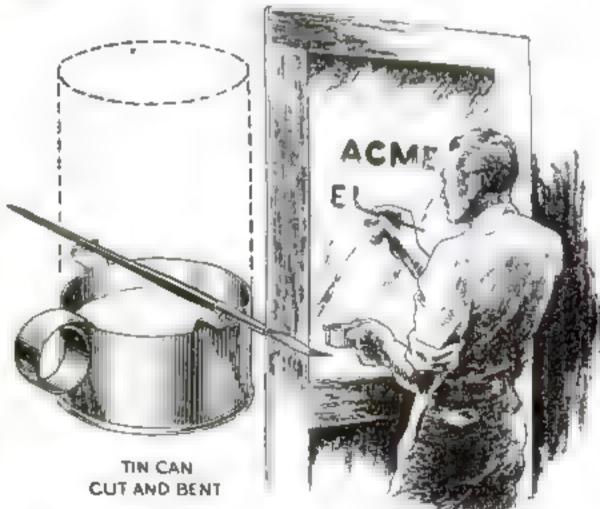
GENUINE granite rock ballast in a miniature size for model railways may be obtained at grain stores in the form of chicken grit. This usually retails in small quantities for a cent or two a pound. Paint the baseboard a little at a time with hot glue, and sprinkle the grit on immediately.—ARTHUR L. D. FORD.

with suggested dimensions 2 CARRIAGE BOLTS 3 CARRIAGE BOLTS 15 WOOD SCREWS 21 CARRIAGE BOLTS

Sponge-Rubber Kneeling Pad Mounted on Casters

Tasks that require kneeling, such as washing floors, are made much easier by using a comfortable kneeling pad or stool mounted on casters. The one shown consists of a %-in. thick board, 8½ by 14½ in., with four ball-bearing furniture casters of the type having hard-rubber rollers. To the board is cemented a sponge-rubber kneeling cushion. Waterproof casein glue, cellulose cement, or a

cellulose cement, or a thick solution of celluloid scraps in a mixture of equal parts acetone and denatured alcohol may be used for this purpose. The exposed wood of the rolling platform is then given two coats of floor and deck enamel, and the casters are applied.



Paint Cup Made from Tin Can

By CUTTING and bending a tin can as indicated above, sign writers, especially those doing window lettering, can make a paint receptacle and brush holder. The idea is equally useful for other small paint jobs.

This rolling knee platform

makes polishing floors and

similar tasks much easier

Keeping Your Home SHIPSHAPE

Kitchen Table Converted into a Handy Cabinet

NY housewife will be more than pleased to have her porcelain-top kitchen table converted into a cabinet like that illustrated. The otherwise waste space under the table can then be used to store canned goods, pots and pans, and other kitchen utensils.

Although any ordinary table can be similarly changed, those in widest use have square wooden legs, so are exceptionally easy to inclose with ¼-in. plywood. The cost of materials in this case was slightly over three dollars exclusive of hardware. There are many styles and prices of hardware from which to choose. That shown is a chromium-plated modern style costing \$3.40 for the complete set.

First, the back and side panels are

nailed on the outside of the legs with %-in. brads, then the bottom, and finally the front. Strips 1 in. square are nailed to the lower inside edge of the sides, front,

and back, and upon these is placed the bottom of the cabinet. A shelf is set as desired by using 1 by 1-in. stock.

The pieces left over when cutting the door spaces in the front panel are now used to make the off-set doors. Stock % by 2 in. is nailed on these pieces as shown. The doors should be % in. larger all around than the door spaces. Enough plywood is left over from the previous cuttings to make another drawer to

match the original one in the table, and the two are centered above the doors.

Extra storage space is always a boon

to the housewife. In this case it is

gained by rebuilding a kitchen table

DUMMY FEET MADE

The addition of small dummy feet greatly improves the appearance. Also, a wooden rack and several hooks may be placed on the inside of each door.

All brads should be set below the surface of the wood, the holes filled with wood composition, and a primer coat and two coats of enamel applied. Sand lightly between coats.—G. S. SEIDEL.



Simple Method of Adjusting Sagging Door

HINGES on heavy entrance doors of shops and homes wear away at the pivot point till the doors eventually

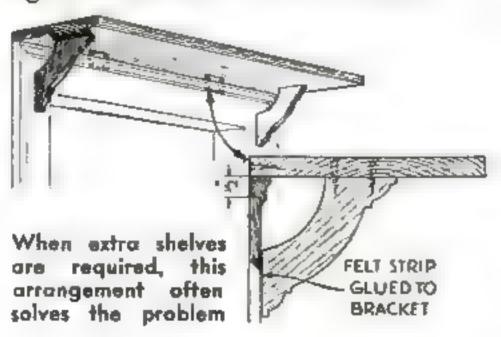
drag on the sill. To repair such a door without removing it, I bushed each worn section of the hinge by raising the door with a pinch bar and bending a nail of the right thickness around the hinge pin.

When a door drags because of the settling of the building, the top edge may be dressed off with a plane. Then, if a thin strip of wood can be placed between door and floor, a handsaw may be run between the two to trim the bottom of the door.—R. O. L.



Removable Shelf Fits Over Window or Closet Door

A REMOVABLE shelf to fit over a window or door may easily be made as below to provide extra storage space. Two metal plates fastened to the shelf are pushed down behind the upper member of the door or window casing, and the felt-covered ends of the brackets rest against the trim.—Axel E. Ogren.





% - 2 WH TE PINE

PRECE CUT FROM
FRONT PANEL (1)

CLEAT NAILED TO

INCLOSING PANEL

Door-Handle Pad Is Made from a Ball

FRONT PANEL

WHERE a door opens against a porcelain sink, refrigerator, or tile wall and the han-

dle is likely to chip the surface, it pays to pad the knob with rubber. Regular protectors are sold for this purpose, but a substitute may easily be made by cutting a hole about 1 in. in diameter in an ordinary rubber ball and slipping the ball over the knob. Talcum powder applied to the metal or glass will cause the rubber to slide on with less effort. It is then unnecessary to attach a door stop to the floor, where it might interfere with cleaning and be otherwise inconvenient.—R. W. BRIGGS.

Spot Welder





The steps may be est form a set of



The secondary coils are covered with cotton tape, the turns being haif-topped so there are two thicknesses

KENDALL FORD GIVES DETAILS OF A LOW-COST MACHINE THAT CAN BE PLUGGED INTO ANY **ALTERNATING-CURRENT OUTLET**

ERE is a small spot welder you can build at a cost that is but a fraction of the price of commercial spot welders of similar capacity. The writer obtained the necessary materials for about fourteen dollars. The unit is compact and portable, and its adjustable leverage and springtension features make it adaptable to an extremely large variety of welding jobs.

While in no sense a substitute for arc welding*, this spot-welding equipment is a valuable adjunct to any home workshop. It is particularly useful in joining together metals that are too light for any other form of welding, but its application lies not in that field alone. Scores of points on the modern automobile are spot-welded together where they were formerly held with screws and bolts.

Spot welders operate on a somewhat different principle from arc welders. In arc

sembly and detail

of pressure orm

15×15×12

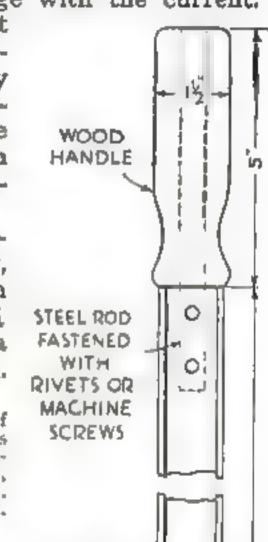
the metal to melt and fuse together. In spot welding, a relatively high resistance joint between two good conducting points is brought to a white heat by the passage of current, then welded together by pressure. As in the case of arc welding, a transformer is used, but the voltage across the secondary is reduced to a few volts, with the current raised in indirect proportion to several hundred amperes.

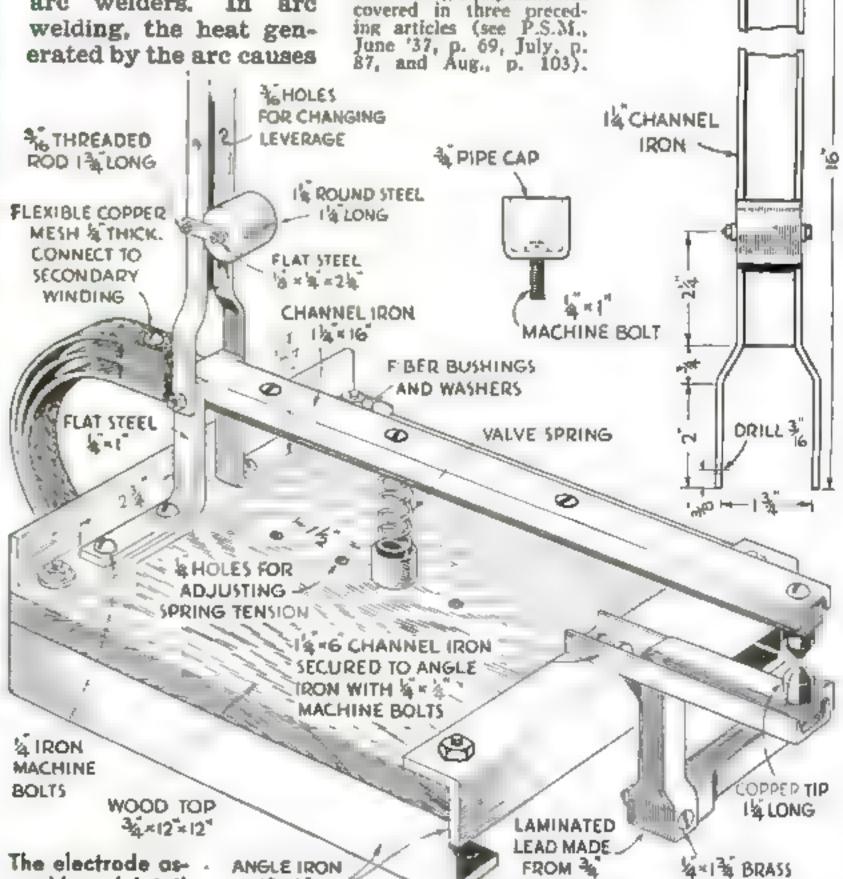
The core, clamps, primary coils, and baseboard are identical with those required for the arc welding transformer. Assemble the core, as outlined for the arc welder (see P.S.M., June '37, p. 69). Wind the two primary colls as directed, but place the two coils on the same leg of the core, with the windings running the same direction. The coils on the welding transformer were placed on opposite legs to cause a uniform variation of the voltage with the current.

In the case of spot welding, the current will be nearly constant for a given weld, so the voltage variation need not be considered.

For the lowvoltage secondary, obtain enough strips of copper 34 in, wide to make a stack ¾ in. high.

"The construction of arc-welding equipment was covered in three preced-ing articles (see P.S.M., June '37, p. 69, July, p. 87, and Aug., p. 103).





MACHINE BOLT

COPPER STRIPS



The strips should be 8 ft. long and may be No. 20 gauge or smaller annealed copper. The gauge is of no importance provided there are a sufficient number of pieces to make the size of laminated conductor required. If copper strips are not obtainable, they may be cut from a larger sheet of copper.

Provide a wood form, 2% in. square and 8 in. long, to serve as a winding form for the secondary. Bind the strips together with strips of friction tape at several points along their length—tightly enough to hold them in place, but not so tight as to prevent a movement of the outside strips as they are wound around the form. Clamp one end of the strips to the wood form, place the form in a vise, end upward, and wind six complete turns around the form. As each turn is wound, the sides and corners should be hammered to shape with a wood mallet.

Remove the coil from the form and hook each end over a nail driven into a board, so that the turns will be separated for taping. Compute the length of the necessary leads at each end of the coil and cut the remaining strips off with tin snips. Begin taping the leads near the end with cotton tape and follow through the coil to the opposite end. The tape should be half-lapped so that there will be two thicknesses of tape on the coil. Tape the turns together, lengthwise through the coil, and cover with shellac or insulating varnish.

Drill ¼-in, holes in the ends of the coil leads so that they may be extended as shown in the drawing. Place the secondary coil over the core leg, with the leads at the top. Insert the remaining core laminations, clamp the core together, and place on a wood base. Provide a ¾-in, top as illustrated.

Two pieces of 1½ by 1½-in. angle iron, 12 in. long, will be required for the electrode brackets. It will be necessary to insulate the rear bracket from the tie rods with pieces of fiber tubing and fiber washers.

Obtain a piece of 1¼-in. channel iron, 6 in. long, for the bottom electrode holder, and drill two ¼-in. holes in one end to bolt it to the front angle iron, and one ¼-in. hole in the opposite end to hold the bottom electrode in place. Cut a ¾-in. hole through the flat part of the channel iron, through which the transformer lead may pass. Bolt the 6-in. piece of channel iron to the angle iron



Left, cleaning the

A view of the transformer to show particularly

how the leads are brought out from the secondary.

The connections are indicated in the diagram above

No More Polishing Brass!

brasses have never been tolerated by the housekeepers of any period or age. It is therefore valuable to know how to polish metal and preserve its brightness with lacquer.

A number of excellent metal polishes for silver, aluminum, or brass are available by mail or local purchase. Any of these will suffice for

brass, although a very good one for the so-called "bright" brass may be made from whiting, alcohol, vinegar, and ammonia. A working formula is ½ lb. whiting, 1 pt. water, 1 cup vinegar, 1 cup denatured alcohol of shellac grade, and ¼ cup household ammonia. Place in a clean, wide-mouthed bottle, cover tightly, and shake well. For a finish of less brilliancy, use FF or FFF pumice stone in place of, or in addition to, the whiting.

When ready for use, the polish should be of the consistency of cream. It may be applied with a rubbing brush such as is used in wood finishing, or with an ordinary shoe brush, or with a suitable wad of old rags. The application and rubbing should be either completely circular or entirely straight in order to develop uniformity in the polished surface.

Of course, if you have electric buffing equipment with either rag or felt wheels, the task is much easier. For this set-up you can buy sticks of prepared commercial rouge or red buff, tripoli, black buff, and white buff for either a bright or a dull finish, as may be desired. The hand formula just given, however, also does well on a rag wheel provided it is made into a much stiffer "mud" by the addition of more whiting or pumice stone. Bright buffs should be done at the highest speed, and dull buffs at lower speeds, depending largely on the cutting medium in use.

On turned work such as candlesticks, where no buffing machine is at hand, the work can be done by using a folded and stitched strip of cotton flannel in a

Applying lacquer to protect polished metal. Right, gleaming copper bowl hung in a window

By RALPH G. WARING

manner similar to polishing shoes. Some means must be found for clamping or holding the brass, since both hands are needed to pull the strip back and forth at high speed.

No matter which method is used, however, wash off the metal in clean water from time to time, or wipe with a soft rag to be certain that no edges, coves, or fillets are missed in the polishing work to detract from the general effect. Repolish wherever necessary.

Next, a careful

washing in hot trisodium-phosphate solution, or a similar commercial cleaner free of soap, should be given, using a cupful to a gallon of hot water. Wash only one piece at a time and have a cloth pad on the bottom of the pan to avoid accidentally scratching the brass. Rinse the freshly cleaned pieces in boiling hot water, remove, and wipe dry with a clean soft cloth in such a manner that the hands do not touch the polished surfaces at any time. This can be accomplished by wearing clean, cot-

ton gloves or using cloths. Set the

pieces aside to cool before proceeding

It isn't necessary to use a lot of elbow grease, once you get the metal bright and protect it well with transparent lacquer



Square, antique Chinese tea urn in a decorative grouping. Careful brushwork is needed to lacquer a piece like the urn

> Whiting mixed with alcohol, vinegar, and ammonia makes a good brass polish

Metal lacquer can now be bought in almost every local paint store or by mail. Clear brushing lacquer for metal or wood, or, as it is known in some sections because of its odor, "banana oil" may also be used, but be sure that the

with the next step—applying lacquer.

may also be used, but be sure that the latter is a metal lacquer and not the reducing solvent, amyl acetate, from which the misnomer "banana oil" is derived.

When the brasses have completely cooled from the last hot rinse and wipe, study each one to determine how it is to be held (Continued on page 122)



By KENNETH MURRAY

NLESS you are unusually expert, some of the film negatives you made with your camera this summer are, for one reason or another, hopeless duds and ready for the scrap pile. But why throw them away? You can easily salvage the celluloid base, and put it to many uses.

Try this: Make a solution of eighty minims (drops) of glacial acetic acid to each ounce of water, and place the films in it. After five minutes the emulsion and gelatin may be stripped off by passing it through the fingers or

using a knife; or, if you care to wait, it will dissolve of its own accord in thirty minutes. Note how shiny and new the celluloid appears. Spend a few cents for some acetone (or use nail-polish remover) and discover for yourself the ease with which it can be cemented or made into a transparent sheet adhesive. Color it if you wish; for this purpose aniline colors are satisfactory. More brilliant results can be obtained, however, by dissolving alcohol-soluble aniline dye in shellac and flowing or brushing it over the celluloid.

Left, scraping off the emulsion. Below, using the celluloid to protect cards and labels by flowing the edges with acetone

Stripping the emulsion from a film roll

so that the clear celluloid may be used

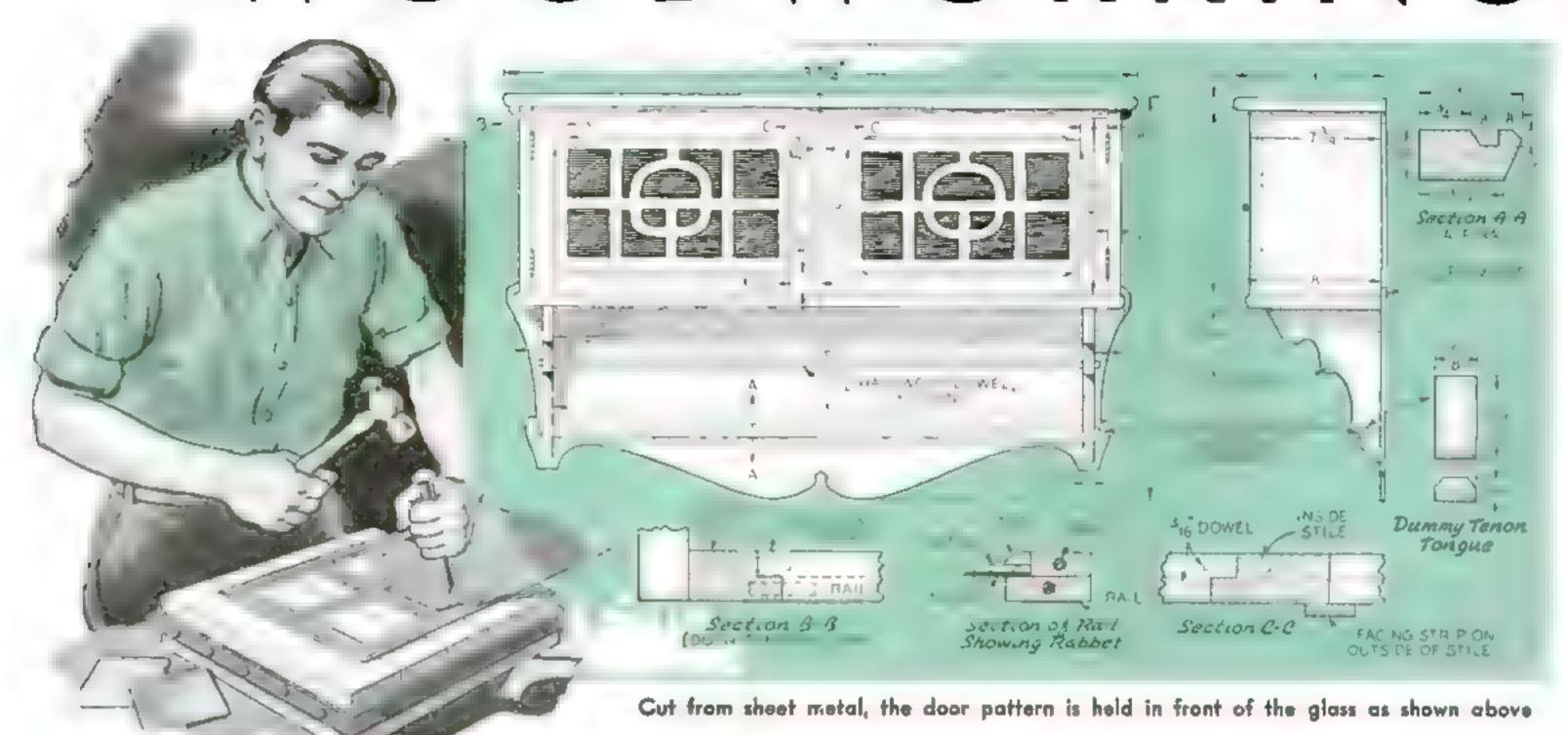
CUTTING FILM.
If drafting stencils
and other odd shapes
are needed, scribe the
lines with a sharp
point, then bend until
the film of celluloid
cracks along the lines
and push the pieces
out. For trimming or
cutting small sheets, a
pair of scissors, knife,
or razor blade will do

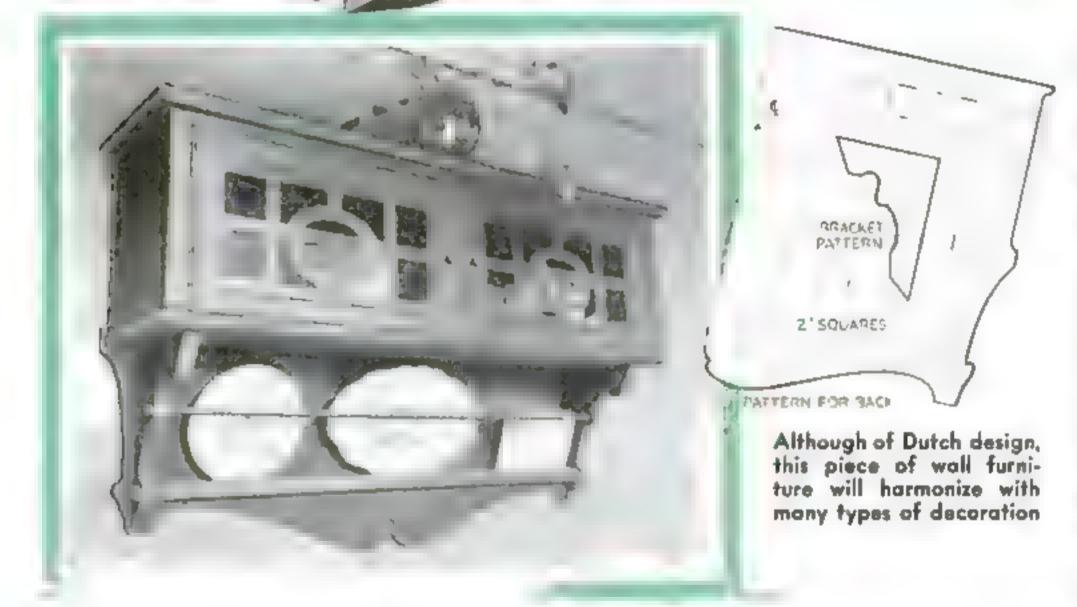
UNBREAKABLE watch crystals can be made by cementing three pieces of cellulaid film tagether. Form them before dry over a wood black shaped correctly. Snap the crystal into the case lid, and coat the edges with acetone to provide a permanent, dustproof seal

Trimming celluloid for a watch crystal after it has been formed on a black

To seal the crystal in place, flow acetone along edges of cover as at right MAGIC NOTE PAD. Coat a sheet of thick, black cardboard with paraffin, then attach a sheet of tracing paper and the celluloid to one end with adhesive tape. Write on the celluloid with a blunt point, and erase by lifting the tracing paper as shown above. This may be done repeatedly

WODWORKING





Quaint Dutch Cabinet and Plate Rail

OR displaying a few choice dishes and providing a gay color note in the breakfast room, hall, or kitchen, this little Dutch wall cabinet and plate rail steps right up to fill your needs.

The quaint door design, made by cutting out a thin sheet of copper, brass, iron, lead, or tin, and placing it in front of the glass, is an old Dutch idea. One doesn't need to have a Dutch house, however, to use this little piece of furniture.

The plywood back is the first part to be made. Lay out on this the positions of the cabinet ends, bottom, brackets, and plate rail, and drill holes to screw these members in place. The cabinet

LIST OF MATERIALS

No Po		T.	w.	L.
1212122411144	Back (plywood) Brackets Cabinet top Cabinet ends Cabinet bottom. Middle door stiles Outside door stiles Door rails Top facing over doors Facing strip for door Inside door stop Glass stops Glass stops	3/16 3/16 3/16	23 14 14 14 14 14 14 14 14 14 14 14 14 14	36 14 9 14 11 36 10 10 14 14 14 16 33 14 10 12 9
1 2	Round wooden dowel Plate rail* Dummy tenon tongues*	77. 14. 14.	11/4	33 31 114

Note: All dimensions are given in inches and are finished sizes. Either hardwood or softwood may be used for all parts. For parts marked with an asterisk (*), see detail drawings.

MISCELLANEOUS

2 pr. 1½-in. loose-pin butts (hinges).
2 pc. 16-oz. window glass, 8¾ by 14½ in.
2 pc. thin sheet copper, brass, black fron, lead, or tin, 8¼ by 14½ in.

or tin, 814 by 1414 in.

2 wooden or metal door polis.

1 friction catch of the bullet type, 1/2 in. (or any small friction catch).

top extends over and covers the top of the back, and is screwed to the end pieces. The cabinet bottom is screwed up to the end pieces.

The front and ends of the cabinet top and bottom are beveled on both upper and lower faces. The stiles and rails of the doors are chamfered.

The rails and stiles are fastened together with halved or end-lap joints, dowels, and glue. The glass rabbet runs the full length of the rails and stiles on the inside face, allowing the sheet metal cut-out and glass to be set from the inside. A small stop is planted on the bottom of the cabinet inside the doors to insure proper closing. A small friction catch on the bottom of the left-hand door will hold both doors in place.

When glazing the doors, the cut-out metal is placed in the rabbet first with the glass behind it. A small wooden stop finishes the glazing.

Loose-pin butts and simple wooden or metal door pulls are needed. The cabinet may be fastened to the wall by two screws.

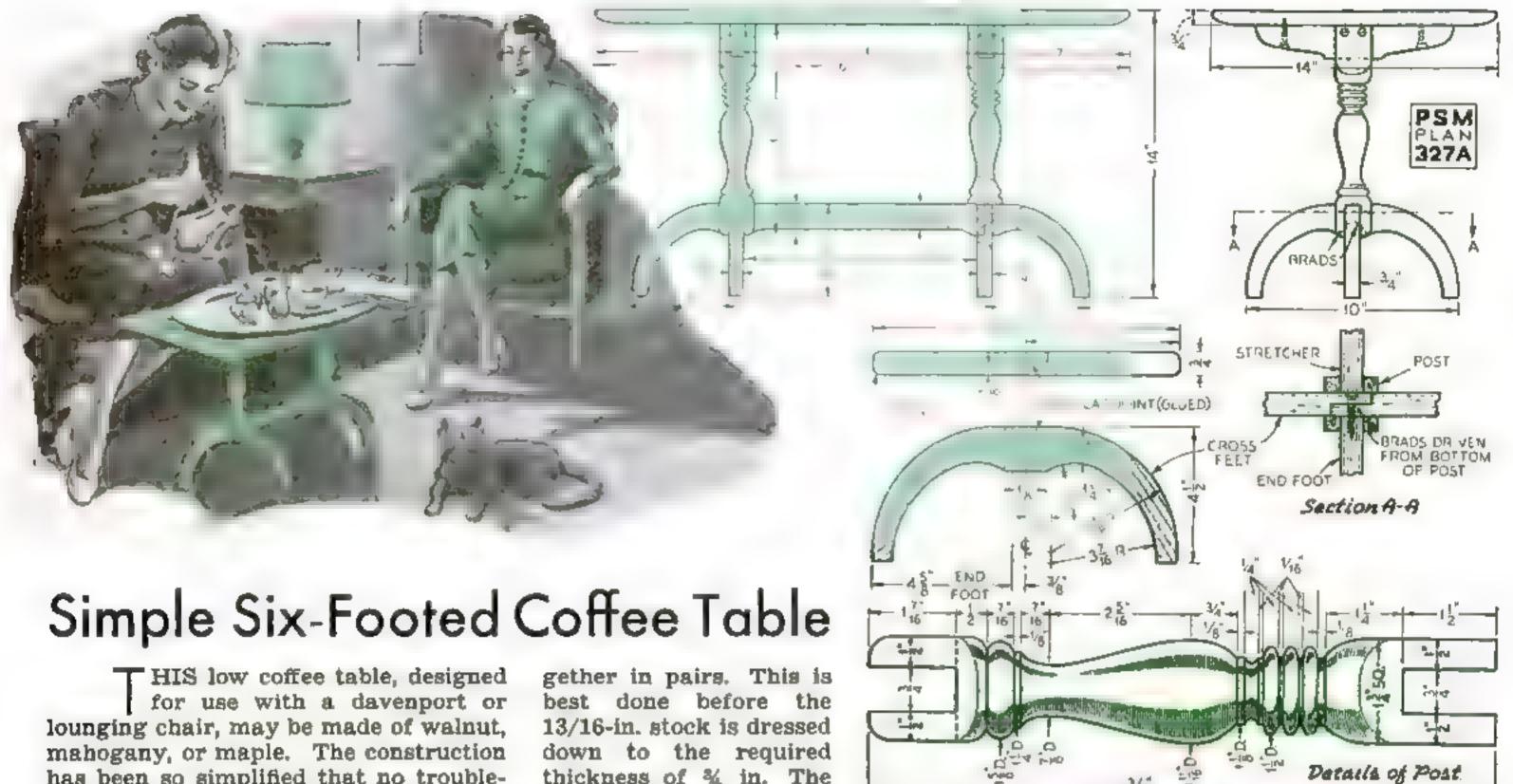
If constructed of hardwood, use stain and wax, or fill the grain and finish with wax in the natural color of the wood. If made of softwood, either stain and wax or finish in a bright color to harmonize with the color scheme of the room.—W. W. WHEATLY.

Special Box for Shaper Cutters

A CASE for holding woodworking shaper cutters can be constructed from a cigar box or any similar box of convenient size. A 1-in, board is fitted and nailed in the bottom, and dowels to fit the holes in the cutters are glued in holes drilled into this board. Care must be taken to space them so that the cutters will not strike together. The dowels should be almost long enough to reach the lid.—MERLE C. FOSLER.

COLORFUL PLATE-RAIL CABINET,

LOW COFFEE TABLE, INLAID CHECKERBOARD



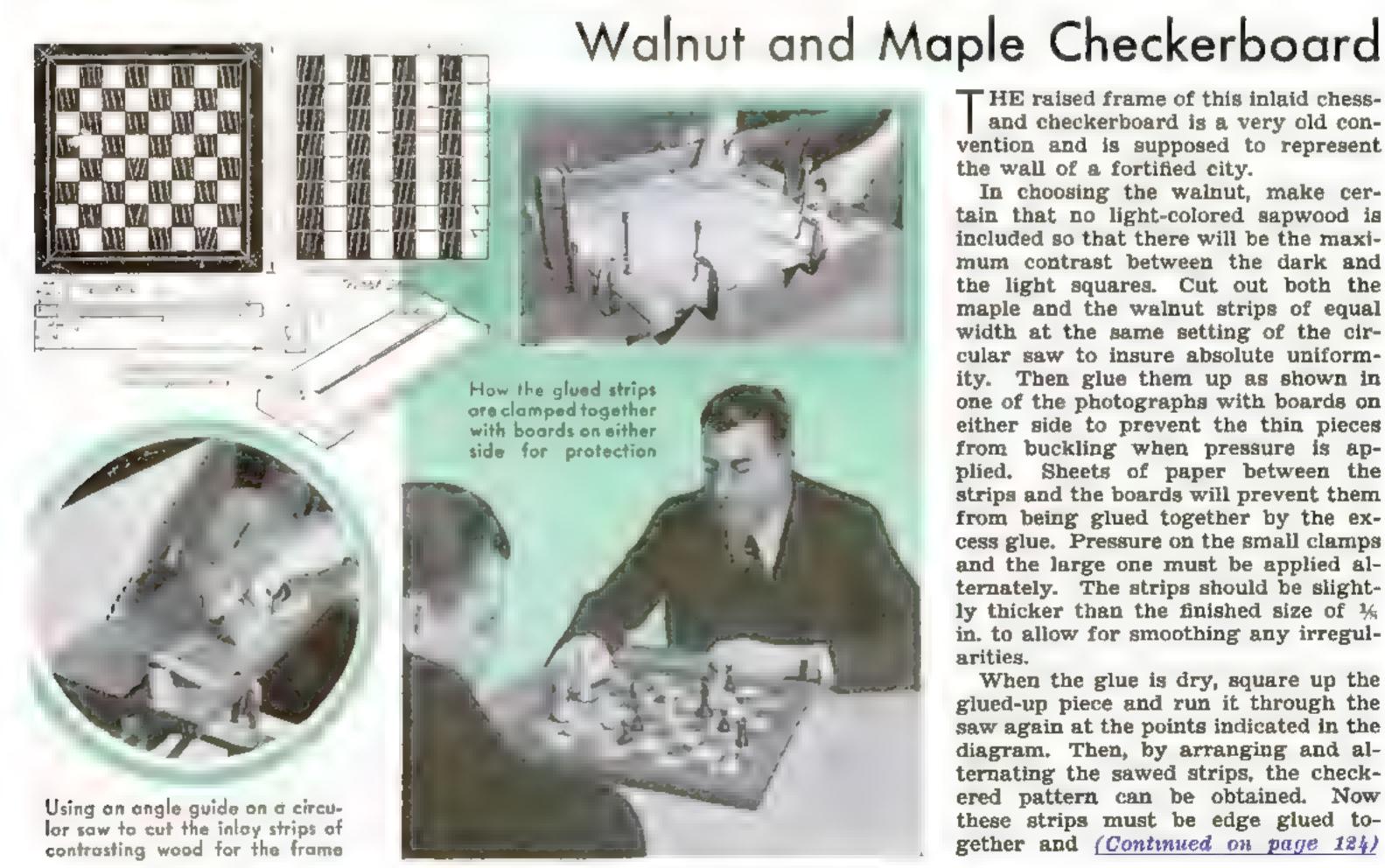
has been so simplified that no troublesome mortise-and-tenon joints need be made.

Lay out the feet with the grain running as indicated by the shading. The two end feet have squared ends measured 4% in, on a horizontal line from the tips. The cross feet have half-lap joints at the center and are glued to-

thickness of ¾ in. The corners of the feet are rounded to a ¼-in. radius.

After being turned, the posts are slotted with a single slot at the upper end for the crosspiece and with two cross slots at the bottom for the feet. Make a trial assembly with screws alone before gluing the joints. When the glue has been applied, clamp the projecting prongs on the post with C-clamps on diagonally opposite corners.-DONALD A. PRICE.

(The list of materials appears on page 124.)



HE raised frame of this inlaid chessand checkerboard is a very old convention and is supposed to represent the wall of a fortified city.

In choosing the walnut, make certain that no light-colored sapwood is included so that there will be the maximum contrast between the dark and the light squares. Cut out both the maple and the walnut strips of equal width at the same setting of the circular saw to insure absolute uniformity. Then glue them up as shown in one of the photographs with boards on either side to prevent the thin pieces from buckling when pressure is applied. Sheets of paper between the strips and the boards will prevent them from being glued together by the excess glue. Pressure on the small clamps and the large one must be applied alternately. The strips should be slightly thicker than the finished size of 1/4 in. to allow for smoothing any irregularities.

When the glue is dry, square up the glued-up piece and run it through the saw again at the points indicated in the diagram. Then, by arranging and alternating the sawed strips, the checkered pattern can be obtained. Now these strips must be edge glued together and (Continued on page 124)



what, with its equipment, may fairly be considered one of the world's most interesting small boats—the New Bedford whaleboat. A result of hundreds of years of experiment and evolution, the whaleboat was strong, swift, and seaworthy, yet so light it could be carried by two men. Every one of its fifty odd pieces of equipment was specially designed for its purpose and had its particular position in the boat, which never varied. These boats are no longer in use and are to be found only in museums.

The scale on which our model is built is ½ in. equals 1 ft. of the original 28-ft. boat. Many of these boats, however, were 30 ft. long.

From the half-breadth plan mark the top outline on the soft pine hull block and cut away the waste nearly to this. The bow and stern profiles may then be cut to templates from the sheer plan, to include the stem and stern posts. The sheer is next cut, either to marks on the work or with the aid of a template; and the sides are rounded until templates from the body plan fit at their respective stations. Note that she is fuller at the bow than at the stern.

In these boats the garboard and two top strakes are clincher (lapped), and the rest are carvel (edge to edge). The edges of the lapped strakes can be indicated by making a shallow knife cut at a right angle to the hull and then shaving to that. Note that the two top planks come to the edge of the stem and

stern, and the others to the beard lines.

Inside, scoop out the hull as thin as possible. A lot of wood can readily be removed by boring holes, but be careful that the bit spur does not come through. A spurless, centerless bit is the best to use.

The keel is wide along the bottom where the centerboard comes through, narrowing to the ends where it meets the stem and stern. I glued mine along the flat part of the bottom and "melted" it into the stem and stern, cut from the solid.

Along the inside of each plank seam there is really a batten, but I omitted them.

To enable you to scale down the parts more accurately and to avoid giving a number of confusingly minute measurements, the dimensions hereafter will be for the most part those of the full-size boat. Make yourself a miniature rule to work with, each ½ in. representing 1 ft.

By Capt.

E. ARMITAGE McCANN

Level with the top planks, inside, are the gunwales, 1½ in. square, running from end to end. On these are strips ½ by 2 in., but they are hard to hold in position, so I made my gunwales narrower and glued the thin pieces on their inner edge to project the right amount above. (Not all boats had these strips.)

HALEBOAT

Outside the gunwales, nearly from end to end, are moldings % in. square, and under the lower edges of the top strakes are similar moldings to within 4 ft. of the ends.

The ribs are of steamed oak, about ½ by 1½ in., with their edges to the planks; they are notched over the battens. One comes at the middle of each thwart, and there are five between. Those at the ends are farther apart. I made mine of two parts of Bristol board, glued together, cut in very thin strips, and glued in position from gunwale to gunwale.

Clamps or battens for the thwarts (seats) to rest on are about 1½ by 2 in. They lie 10 in. from the top of the gunwale and extend nearly to the ends.

The bottom boards (called the

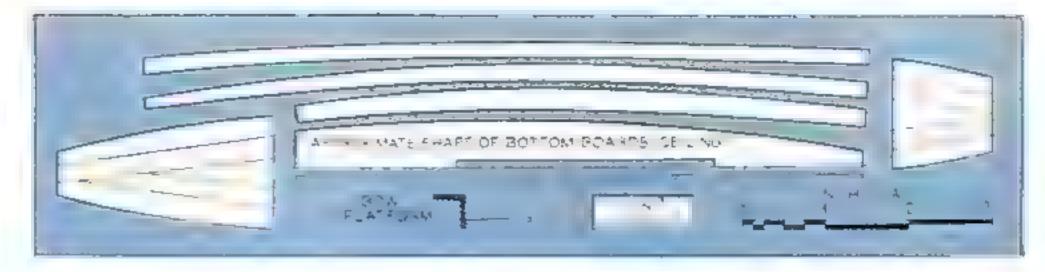
"ceiling") are about ½ by 8 in. Any very thin wood will do; 1/16-in. plywood is suitable. The four center ones can be in one piece, but outside of them, planks will have to be shaped and cut. At each end are horizontal platforms, scribed to look like planks.

Thwarts, 1 by 8 in., can next be fitted. To stiffen them and the boat, they have either steamed oak knees with filling pieces behind, or grown knees. The latter shape is the easier to fit. If these are tightly fitted, no nailing will be necessary. The second thwart is double kneed. The three center thwarts cannot be fixed until the centerboard trunk is in.

The centerboard is a flat piece of metal with hinge and hoisting holes. In the model, the trunk consists of two pieces of 1/16-in, thick wood, with similar pieces between them at the ends and top to form a slot in which the board works. The point of the board pivots on a pin. It is pulled into the trunk with a wire rod fastened to the board with a wire ring. When the board is up, the end of the rod slips under a cleat on the trunk. The ceiling and ribs are cut away to allow the trunk to rest on the bottom of the boat (where the keelson should be). The top of the trunk is notched to take the thwarts.

To the after knees of the mast thwart are attached little racks to hold the lances to port and spare irons to starboard. These can be made by doubling a very thin piece of metal around a ½-in. pin, then filing three slots, just large enough to take the shafts of the irons. They can be fastened to the knees with very thin wire, through two holes. The irons slip in the notches, and the pins are replaced.

The mast tabernacle is a curious feature, which most but not all boats had. To build it, first set the mast step in position, then fasten parallel planks 6 in. (to scale) apart between the forward thwarts; fit a plank from the for-



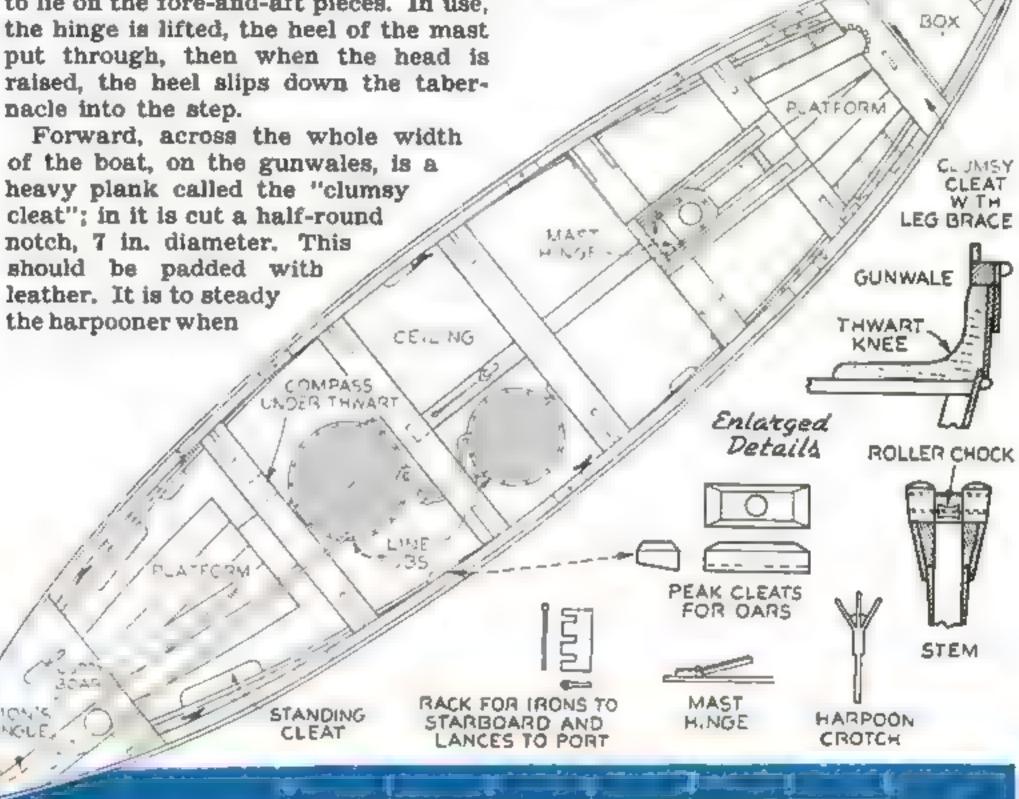
Platforms and floor. Note knife in sheath at bow platform for cutting line in an emergency

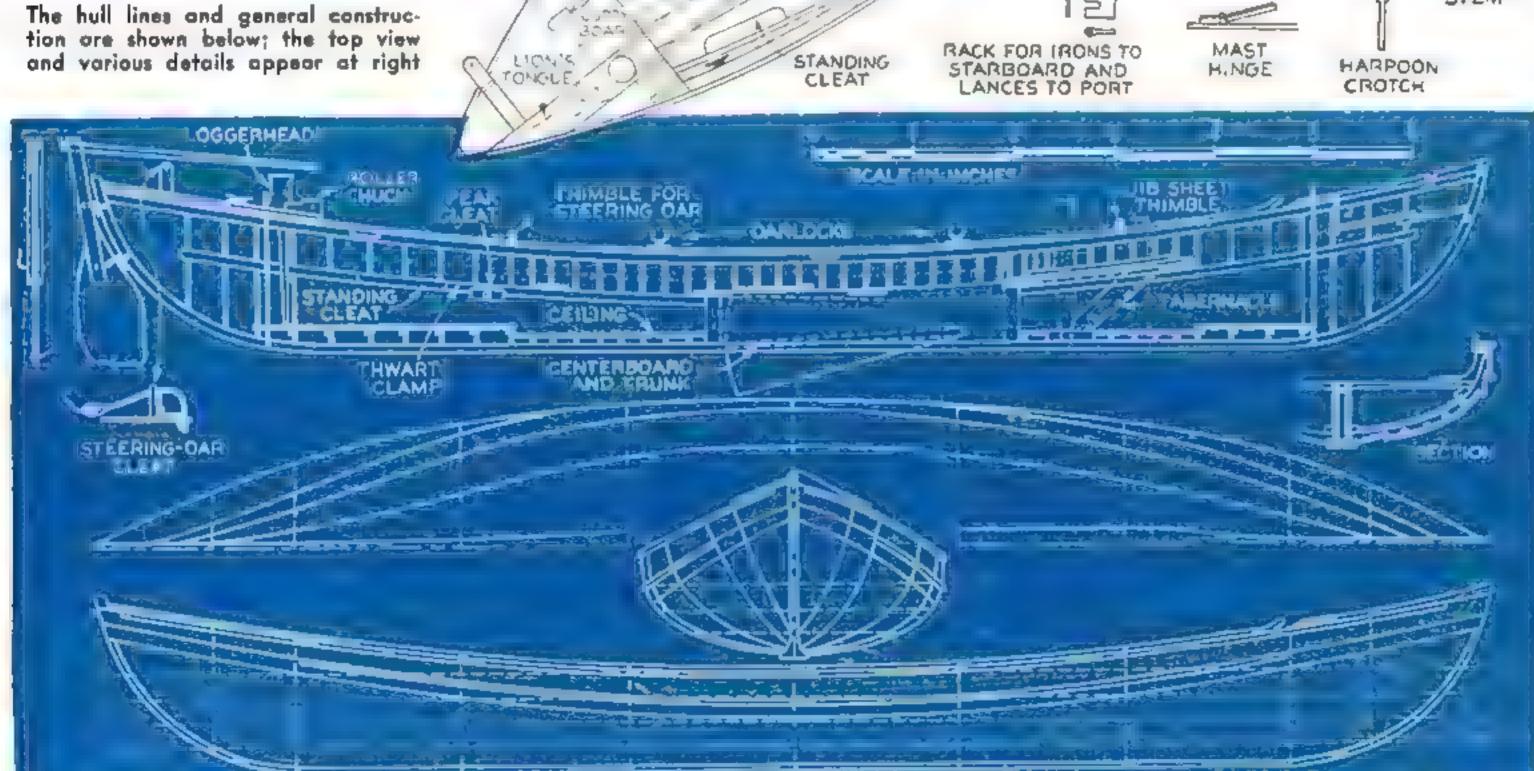
ward thwart sloping down to the step, and on either side of this set 6-in. planks, upright, cut to go under the fore-and-aft planks and to the floor. Next make the mast hinge, the largest part of which is a piece of wood, 11 in. wide by 18 in. long, with a hole to take the mast. On this is fastened a Ushaped piece of metal in which is worked a hinge on either side; the wood is then cut through at the hinge level; and the after part is fastened to the thwart with the hinge in line with the thwart edge. The forward corners are cut off and battens are fitted around it to lie on the fore-and-aft pieces. In use, the hinge is lifted, the heel of the mast put through, then when the head is raised, the heel slips down the tabernacle into the step.

throwing the iron. Forward of this on the gunwale are two shaped, heavy pieces, extending to the stem but not meeting; between them, on a pin, is a little roller for the whale line, and above that holes for what should be a thin wooden chock pin to prevent the line from jumping. A common pin will serve for this. At a point 6 in. down from the top of the gunwale there is a platform, closed in aft with a bulkhead to the clumsy cleat and joined to the stem with a 9-in.

board. Under- (Con-

tinued on page 123)





Leather Name Plate Ornaments Desk

ALTHOUGH the materials for this leather name plate cost less than one dollar, it makes a distinctive gift for any man or woman who has a desk in a large, open business office. The Billings (Mont.) Homeworkshop Club was awarded a prize for the idea in a three-hour project contest of the National Homeworkshop Guild.

For the foundation, cut a triangular block of wood 10 in. long, 3\fmi in. high, and with a 1\fmi-in. base. A hole may be drilled length-

wise to make it lighter.

Draw the general design on tracing paper, and add the lettering in any style desired. Cut a piece of tooling calf 9½ by 10½ in., dampen with a sponge or wad of cotton soaked in water, and place on a smooth surface. Secure the paper and leather with thumb tacks; then transfer the design with a tracing or modeling tool, using a straightedge for the border lines. Remove the paper and go over the work, pressing down firmly. Dye the dark parts, and ball-peen the back panel lightly to give a mottled effect. Punch the lace holes approximately 3/16 in. apart all the way around the leather about 3/16 in. from the edge.

From any thin leather cut two pieces for the ends of the name plate as shown in the drawing. Punch holes to correspond with those in the main piece. Wrap the leather around the block and stitch with black thong lacing 3/32 in. wide, Don't assemble until dry.



Model Plane Supplies Kept Handy in Rack

In constructing model airplanes, a holder made as shown from a piece of "2 by 4" about 8 in, long and a sheet of tin is helpful. Bottles of glue, cement, and paint are set in holes in the block and thus kept from spilling. Brushes are placed in the long V-shaped groove in the wood. The tin, which is fastened to the block with screws, forms a holder for delicate balsa-wood strips and parts.—Lee ADAMS.

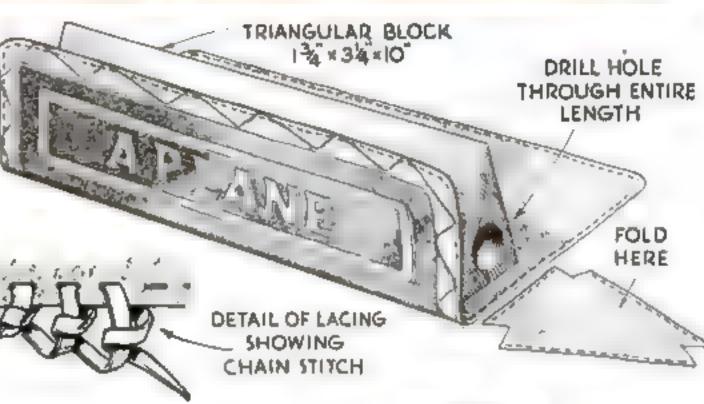
Twisting Wires into a Cable

WHEN it is necessary to twist a number of fine wires into a cable, it is often advantageous to fasten one set of ends in a vise, and grip the other set of ends in the chuck on a brace or hand drill.—MILDRED E. HICKMAN.

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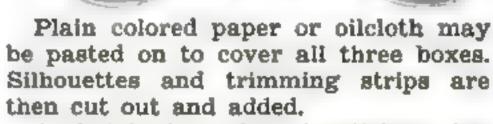
On well-appointed office desks, this tooled-leather name plate is far more appropriate than the ordinary commercial varieties



Neat Canister Set Holds Special Food for Pets

With an inexpensive homemade canister set like the one shown, there will be no more hunting for the bird seed on the shelf, for the fish food in a drawer, or for the box of dog biscuits in the pantry. Canaries usually have a variety of foods, but all of these can be left in their original containers and placed in the canister which bears the bird silhouette.

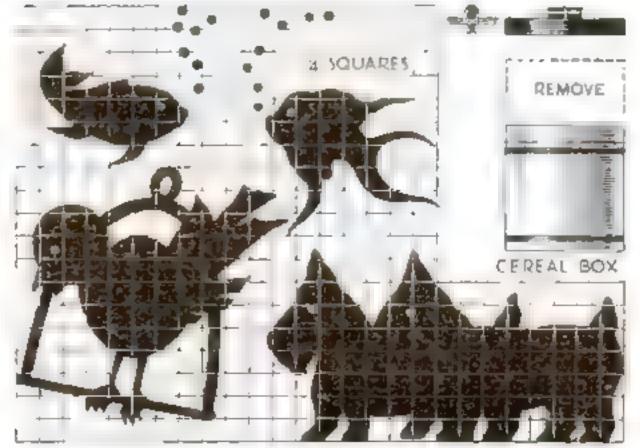
Make the boxes from small oatmeal or similar containers. Cut two of these off 2½ in. down from the top edge. Run a knife line around the box % in. below the new edge and peel off a strip of paper label to allow the cover to fit on in its new location.

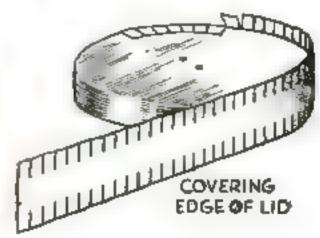


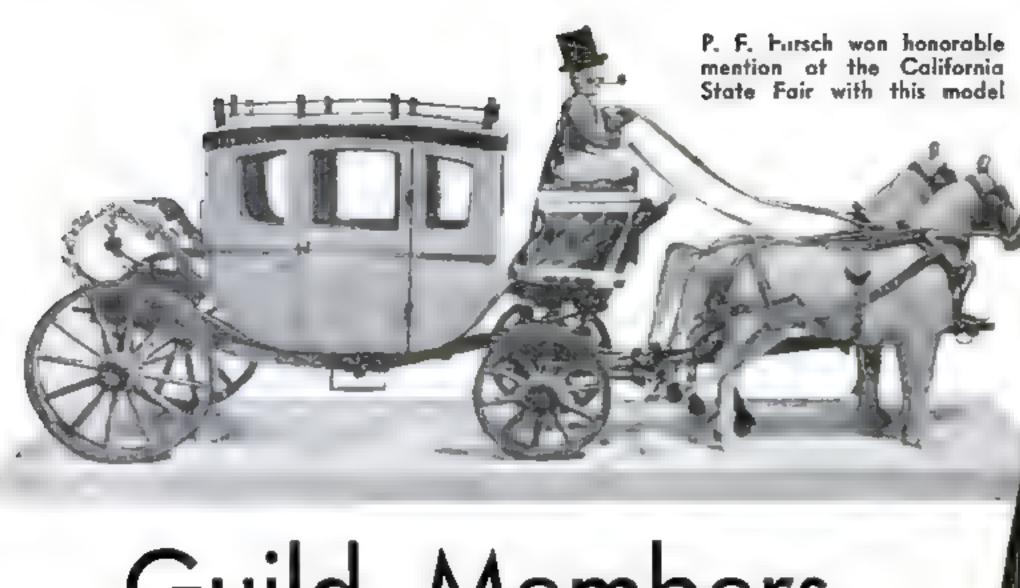
A sketch shows how to stick on the cover edging. This strip is 13½ in, long and 1½ in, wide, with both edges slotted ¼ in, in and ¼ in, apart as shown. The bottom edge is turned up underneath. The top circle is then added.

Pieces of ½-in. dowel are wired on to serve as handles. A 1-in. strip of wood underneath allows the soft wire to be twisted tight without cutting

through the cardboard, and a notch prevents the wire from slipping off the dowel. Paste a circle of paper over the strip of wood inside the cover. Paint handles black.—JOSEFA CLARK.







Guild Members Show Great Gains in Craftsmanship



Madel yacht, 50-800 class, built by Leslie G. Mann. of Springfield, Mass.



R. WRIGHT B. LEE, of Eugene, Ore., makes jig-sawed toys in his spare time and gives them to kindergartens. Whittling is the hobby of A. O. Stenwick, of Red Wing, Minn.,

who carved a raven that won a prize in the National Homeworkshop Guild's whittling contest. Model making interests P. F. Hirsch, of Newcastle, Calif., and his Napoleonic coach was awarded honorable mention at the California State Fair. A wood-carving display won a set of carving chisels for David Lundgren, of Waukegan, Ill., at a recent exhibition.

Countless projects such as these are being made daily in home workshops throughout the country, and craftsmanship has shown a decided improvement in the last few years. A great deal of the credit for this can be allocated to the National Homeworkshop Guild, with which all the men just mentioned are affiliated through their local clubs.

Four years ago the Guild was organized for the purpose of forming clubs, and each group joining the organization must promise that "all activities will be undertaken with a view of helping members develop their skill in craftwork and of promoting the home workshop hobby,"

Demonstrations and lectures arranged by many clubs have proved to be of invaluable assistance to their members. One club went a step further than the usual programs last year, and the result was so successful that it will be resumed this fall. This was the Lincoln (Nebr.) Homeworkshop Club. It arranged with the University of Nebraska to hold one meeting a week at the college and have A. E. Easton, instructor of woodworking, lecture on various topics, including laws of design,

furniture construction, lathe work, finishing in the lathe, and wood carving. One hour was spent in class and one hour in the shop at each session.

Other clubs, not fortunate enough to be near a university, have arranged for demonstrations and instruction by local manual-training teachers. But no matter what type of program is being carried out, craftwork has definitely improved among the

members, and recent exhibitions have attracted considerable at-

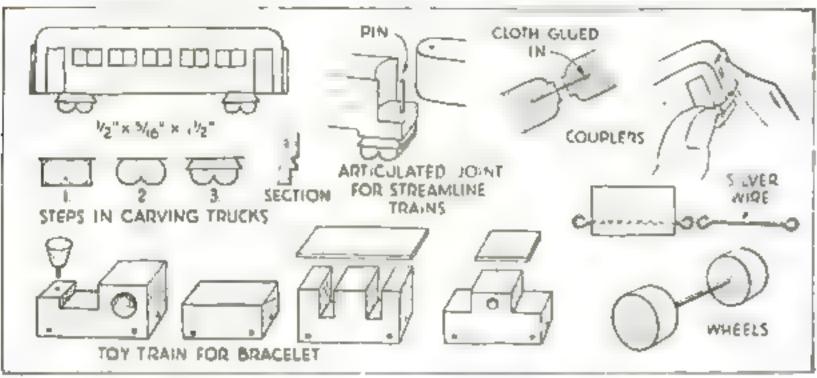
A raven whittled by A. O. Stenwick, Red Wing, Minn., and left in the natural wood

tention (see P.S.M., Aug., '37, p. 95). Leo St. Jacques won first prize with his solid mahogany sewing and utility cabinet at the (Continued on page 114)



Shop of C. H. Russell, a member of the Newcastle (Calif.) Homeworkshop Club. He is working at the scroll saw, with P. F. Hirsch, secretary of the club, looking on





Sketches suggesting a few of many ways to whittle miniature train parts

ALL abo-o-o-a-ard! Find some bits of wood, a few odds and ends of very fine wire, and a sharp penknife, and whittle a miniature train or two.

The passenger train illustrated is about 7 in. long, but only a trifle over ¼ in. high. The simplified toy train is about 5 in. long by ½ in. high. If made of rare woods and finished in natural color, the latter may be developed into an unusual costume bracelet.

The trick in carving all such small pieces is to use a stick long enough to handle conveniently and do the work at one end. The sketches suggest various methods of construction.

Either water or oil colors may be used for painting the models. I usually make each coach a different color, unless the miniature represents some train that is itself distinctively colored.

The train used as a novelty bracelet is unpainted, but contrasting woods are used, and the natural colors are brought out with a light application of linseed oil.—E. J. TANGERMAN.

Clamp Keeps Badminton Rackets Flat

BECAUSE of the extremely light construction of badminton rackets, a clamp is essential for keeping them flat while not in use. Five-ply wood ½ in. thick is best for this purpose as it will not warp. If desired, weight can be saved by using three-ply wood for the separator.

The clamp illustrated, which requires three pieces, was designed for regulation size badminton rackets, which usually come in pairs. Clamps consisting of two pieces can, of course, be used on single rackets. They are ideal for squash rackets.

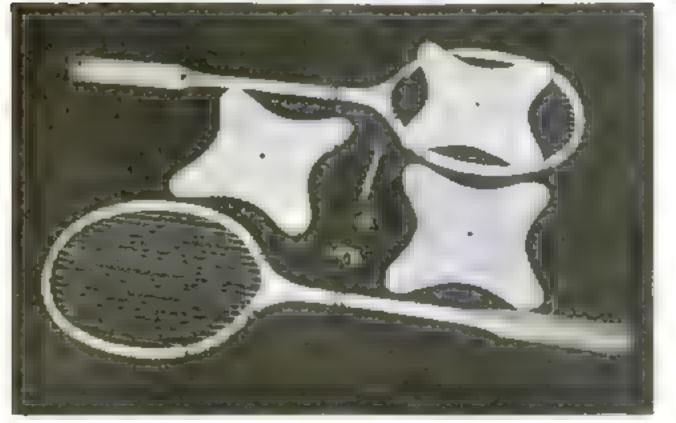
The plywood can be lightly nailed together and bandsawed to shape at one time to insure uniformity. While one side of the outer pieces may be shellacked or varnished, if desired, avoid the use of any finish on the surfaces that come in contact with the racket frames.—C. K. FANKHAUSER.



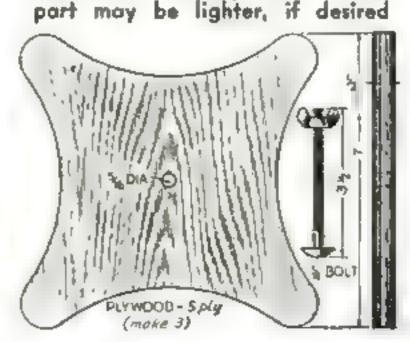
Bottles Cut with Aid of Soldering Iron

AFTER trying many ways of cutting off the top of a bottle, I hit upon a method that rarely fails. I have, indeed, been able to cut a variety of shapes, including even a scalloped edge. Simply file a shallow groove around the bottle with a three cornered file, then insert the point of a small, hot soldering iron in the file mark. A short crack will appear. "Chase" this crack around the file mark until the bottle is completely separated.

A cradle may be made of scrap wood if necessary to hold the bottle during both of the operations.—Earle Hanson.



The three parts of the clamp, and the bolt and wing nut



Badminton rackets in the clamps.

Below, the drawings. The center

Darkroom Conveniences

ANY AMATEUR PHOTOGRAPHER CAN MAKE FOR HIMSELF



Colored light is reflected around the edges of the timer dial so as to illuminate the face

TIMING is of essential importance in every step of photography. In the darkroom I found it a nuisance to have to peer at the clock, so I made the illuminator illustrated to suit a standard photographic timer. The materials required were a sheet of tin, a night light with shade and single plug socket, a block of wood or plywood ½ by 5¼ by 5¾ in., and some wire, nails, rivets, and the like.

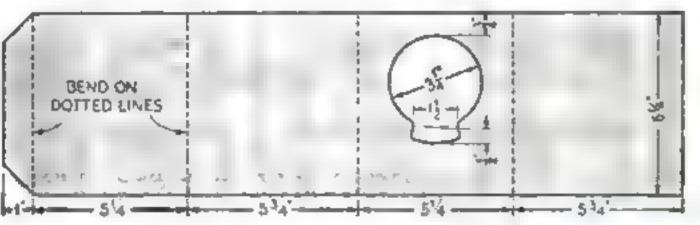
The socket was fastened in the middle of one of the 5¼-in. ends of the block, 1 in. from the edge. A hole drilled diagonally through the wood let the rubber-covered wire out of the illuminator with the least leakage of light. The sheet of tin was cut and bent as shown, then riveted to fit snugly over the block, to which it was screwed.

The removable light-tight top was made from two pieces of tin, one 5% by 6% in, and the other 6% by 6% in. On the larger piece, a %-in, border was marked and folded up; on the other, a %-in, border was similarly marked and bent. One pan was then riveted inside the other. This cover fitted loosely over

on side with ivory drop-black paint, but the front and back with white gloss enamel.

I have found it advisable to have the clock back about ½ in. from the front of the box to get the best light and still be safe. The light that escapes out the front is

be safe. The light that escapes out the front is negligible under average conditions. Green, red, or orange bulbs can be used in the light box, depending on what sensitized material one uses.—Charles J. Long.



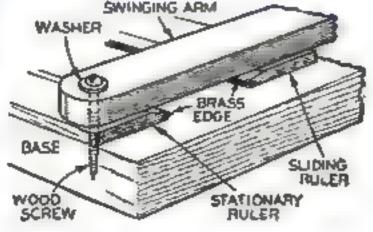
Paper Holder Speeds Enlarging

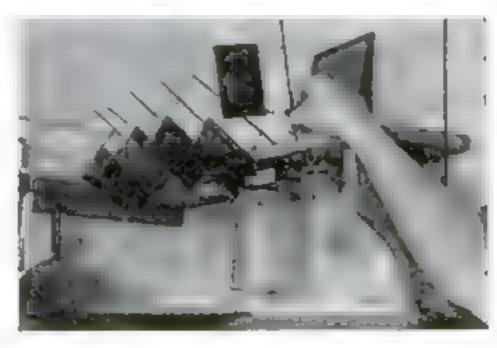
By USING a paper holder like that illustrated, the amateur photographer who prefers borderless enlargements for mounting or framing can make them



with practically no waste of paper. The materials used are: a wood or plywood baseboard about 12 by 15 in.; two thin wooden rulers with narrow projecting

brass edges; and two strips of wood about ¼ by ¾ by 12 in. The thickness of the baseboard doesn't matter, but it should be thick enough to prevent warping. If the enlarger is of the autofocus variety, place a block of wood of suit- (Continued on page 128)





the box and, when painted, was light

tight. Although harder to make, it is

more convenient if the back of the lid

and box form a hinge joint. The top,

bottom, and two sides were painted in-

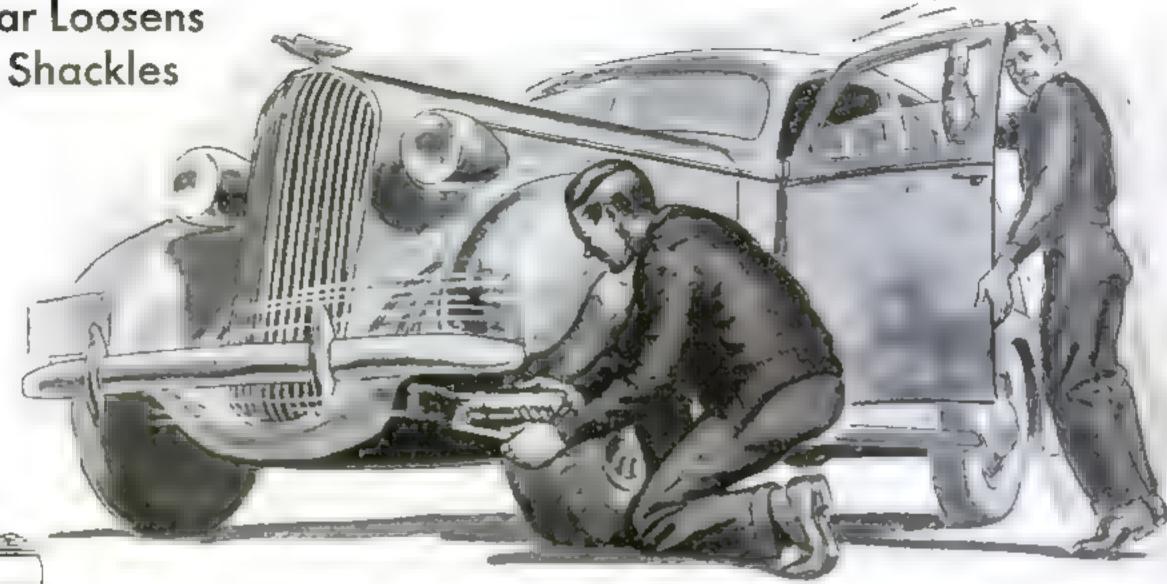
Shelf Provides Place for Drying Cut Film

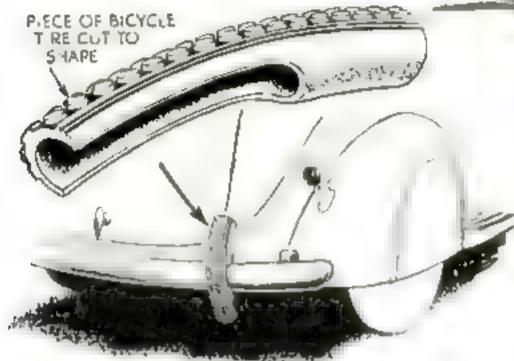
Cut film or film-pack film may be dried conveniently by inserting the rod of each clip or holder into a hole drilled at an angle into the edge of a shelf, preferably over the sink, as illustrated above. Since one corner of the film is low, drainage is facilitated and undesirable water marks are avoided.—R. L.

Timely Aids for Autoists

Rocking Body of Car Loosens "Frozen" Spring Shackles

SPRING shackles that are jammed can be loosened for greasing by flexing the car springs beyond their normal bending point. To do this, open one of the car doors and swing it up and down slowly, increasing the amount of swing each time. Meanwhile, have someone apply a grease gun to the "frozen" shackle. The joint will soon loosen so the grease can be pumped in.—C. F.



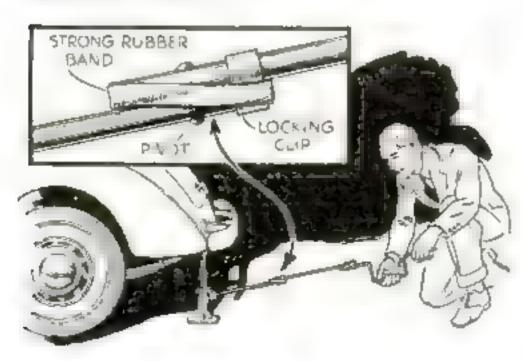


Bicycle-Tire Cushions Protect Bumper Guards

To protect bumper guards from direct contact with other cars, which is likely to scratch the plating and expose the metal beneath to rust, cut pieces from an old bicycle tire to the shape pictured, and slip one over each guard. The tire segments fit snugly and the tread pattern makes them an attractive accessory.—E. F.

Heavy Rubber Band Locks Joint of Jack-Handle

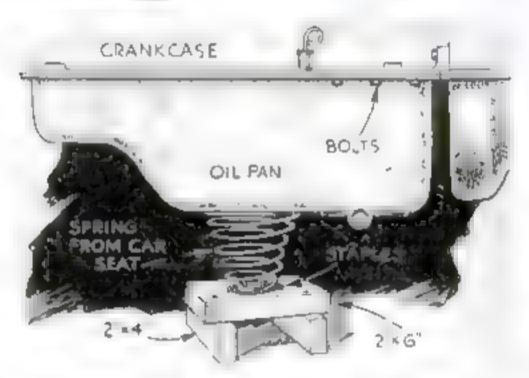
To prevent the common type of extension jack handle from "jackknifing" when pressure is applied, slip a heavy rubber band over it in the position shown below. When the handle folds up at the wrong moment, it is because the locking clip has shifted from its correct position. The rubber band holds the clip in place.—E. T. G.



Dampened Sponge Removes Hair From Upholstery

ONE car owner, who carries his dog along on motor trips, found that the animal shed hair on the mohair upholstery, making it very difficult to clean the inside of the sedan. A vacuum cleaner, whisk broom, and other conventional cleaning methods failed to remove the embedded bristles. Finally, as an experiment, he tried rubbing a damp sponge over the seat covering. Much to his surprise, the sponge gathered the hairs into a matted mass that could be picked off easily with the fingers, leaving the upholstery in perfect condition.—B. K.





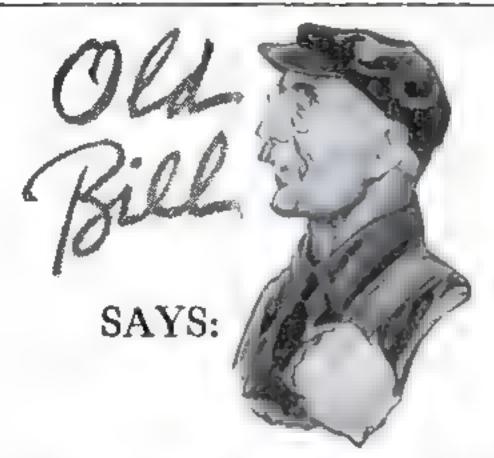
Ingenious Spring Support Holds Up Oil Pan

TAKING off or replacing the crankcase oil pan is made a simple one-man job by the novel arrangement shown in the drawing above. It consists simply of a large coil spring taken from an old seat cushion and fastened with staples to a wooden framework that will bring it to the right height for supporting the pan. When the oil pan is being removed, the spring keeps it in place until all the bolts are taken off, and when the pan is being replaced, the holder supports it in the right position, leaving both hands free to line up the gasket holes and start the bolts, which, on many automobiles, are difficult to get at .--A. W.

Cleaning Carburetor Air Silencer with Plumber's Suction Cup

THE air silencer on a modern car can be cleaned thoroughly with a plumber's suction pump. To do the job, I screw the top of the silencer to a board, as shown at the right, and pour about a pint of gasoline into it. Working the suction cup up and down forces the liquid through the screen and flushes out the dirt. If the filter is very dirty, it may have to be flushed more than once. When the filter is clean, I oil it in accordance with the manufacturer's instructions.—W. C. W.





AVOID, wherever possible, the use of taper pins and set screws in the construction of fine instruments and model work, as these fastening devices always set up strains. If taper pins must be resorted to, be sure they are of the correct taper and drive them lightly in place.

Periodically oil lathe and drill-press chucks to obtain maximum gripping power. And don't forget the bench-vise screw.

Ordinary pipe cleaners are excellent for cleaning out oil holes and conveying lubricants to inaccessible places.

To make paper adhere to metal, add one ounce of a solution of chloride of antimony to six ounces of paste, glue, or mucilage.

If hard or chilled iron must be drilled, heat it to a cherry red and place a piece of sulphur on the place to be drilled.

For tempering small thumb screws and similar metal parts, an ordinary can lid filled with fine sand and any improvised hot plate may be used. The polished parts are placed in the hot sand and can readily be observed as they change color. When the proper temper has been reached, as indicated by the color, the parts are quenched in water.

When a tap or stud breaks at or above the surface of the work, removal is made easy by brazing or welding a nut onto the protruding end and backing it out with a wrench.

If some petroleum jelly is rubbed on the hands when delicate tools or instruments are to be handled, it will help prevent the development of rust spots.

To find out whether a piece of steel or iron has sustained an invisible fracture, soak it overnight in oil, wipe clean, and coat with chalk or whiting. Oil seepage from any cracks in the metal will leave a definite stain on the white surface.

Be particularly careful to remove all burrs and irregularities from a metal gear if it is to mesh with a fiber gear.

Drill jig bushings over ½ in, should be made from machine steel and casehardened. There is no advantage in using costly tool steel.

Keep a new untreated oilstone in a bath of oil for several days. An oilstone must be thoroughly saturated because the purpose of the oil is not to soak into stone, but rather to remain on the surface and float the metal removed by abrasion, thus preventing the stone from becoming loaded with metal particles.



"I Warn Men Against Using Misfit Blades

-says St. Paul Druggist

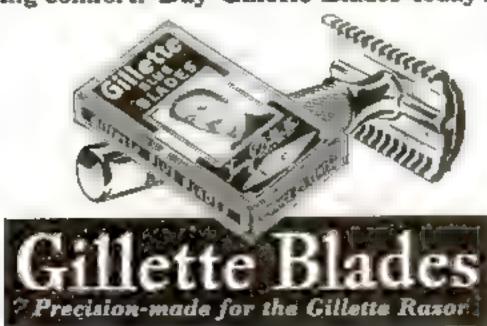
Users Praise Teamwork of Gillette Razor and Gillette Blade





Enjoy The Teamwork' Shave of a Gillette Blade in Gillette Razor

MEN, if you are not enjoying real shaving comfort, you are probably using MISFIT blades in your Gillette Razor. The shaving edges of a misfit blade do not fit accurately in your Gillette Razor. Too much edge leaves your face raw and irritated! Too little edge causes the razor to skip over the bristles and you don't get a clean shave. Why experiment? The Gillette Blade and Gillette Razor are made for each other. They work perfectly together in giving you the best in shaving comfort. Buy Gillette Blades today!





OMBINING the advantages of both the leeboard and the centerboard, this fin-type keel simplifies the task of adapting a canoe or a small boat for use with a sail. All difficulty of launching and landing on a beach or in shallow water is overcome by making the keel retractable.

The keel should have a minimum area of 2 sq. ft. Although a deep, short keel gives exceptional maneuverability, the longer shallow type is easier to make and adds only a few inches to the draft.

Saw and plane a spruce, pine, or hardwood board to the shape decided on. Cut grooves to seat the metal couplings and drill a hole near the front end of each groove to hold the spur snugly. Bend the hangers or couplings from a piece of 3/16-in. brass rod or from nails of suitable size. Fasten them with copper staples. Drive screw eyes into the sides about 21/2 in. from the bottom of the fin. Countersink them well. Sand the fin smooth, apply two coats of varnish, sanding lightly between coats, and set aside to dry.

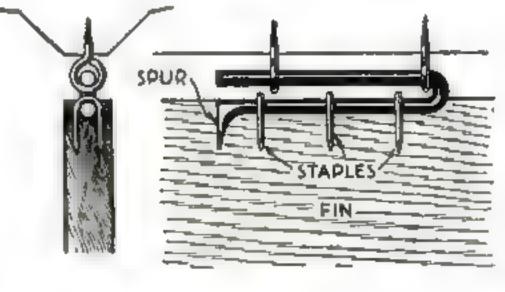
Insert screw eyes in the keel of the boat so the center of the fin will come under the widest section of the boat. In the gunwales, insert other screw eyes for two guys on one side; and use either a screw eye or a cleat on the other side for the lanyard. I prefer a screw eye because it is cheap, easily installed and removed, and prevents the knotted end of the lanyard from being dropped overboard when released.

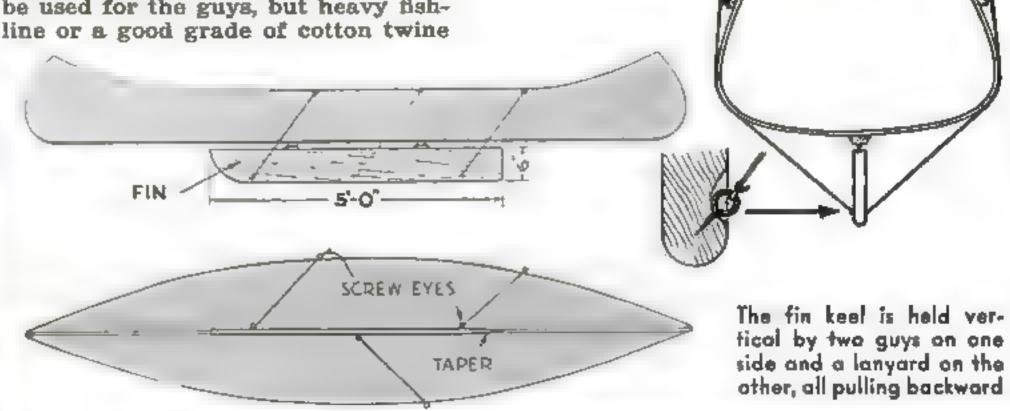
Steel piano wire or copper wire may be used for the guys, but heavy fishis satisfactory. The lanyard should be of cord and long enough to enable the fin to fold flat against the bottom of the boat, which is its position for launching. When deeper water is reached, pull the lanyard taut and tie it securely. Release it again when landing or beaching the boat. Note that guys and lanyard are arranged to exert a backward pull.

If it is difficult to tack sharply into the wind or if the boat has a tendency to fall off to leeward, reset the screw eyes so the keel is several inches nearer the bow. If, however, the boat seems to fall off too easily when running before the wind, move the keel a few inches the other way.—Zussman Freeman.

Right, how lanyard is hitched to screw eve if no cleat is used. Below, the fin hanger



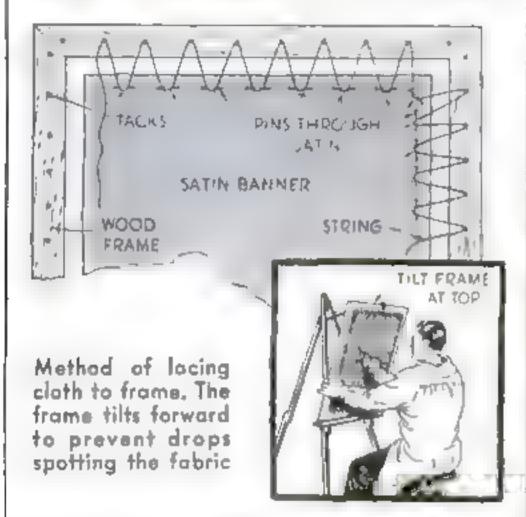




How to Apply Gold Leaf on a Silk Banner

more and more by amateur craftsmen for gilding purposes now that methods of applying it are better known and kits can be obtained with all the necessary materials. Sometimes, however, an unusual problem will be encountered such as the application of gold-leaf letters on a silk or satin-finished banner.

Make a frame larger than the banner and lace the banner to it as shown.



Transfer the letters or design to the cloth, preferably by perforating the drawing with a marking wheel or pricking needle and using a pounce. Set the frame up on an easel or any suitable support in such a way that it is tilted forward at the top so that no drops of paint or size will fall on the fabric.

Build up the surface of the fabric with thick white sheliac, applied in as many coats as necessary to obtain a smooth surface for gilding. Do this only where the lettering or design is to go.

When the shellac coats are thoroughly dry, proceed with the lettering, but be careful to keep the paint or size within the bounds of the shellacked area. For gilding, use either the so-called "quick size" that comes with gold-leaf kits or a mixture of one third quick-drying rubbing varnish and two thirds Japan gold size. Add a little yellow so you can see where the size has been laid on. When the proper degree of tackiness has been reached, apply the gold leaf as usual.

Paper-Pulp Scenery for Model Railway

Paper pulp has many advantages for making model railway scenery. It costs little, is easily modeled into any shape, and is strong yet comparatively light.

Tear old newspapers into small pieces, let soak overnight, and then grind it to a pulp on a washboard or run it through a meat grinder. Better yet, put it in a washing machine (one, of course, without a pump to become clogged) and let it run for about half an hour. Strain the pulp into an old salt or sugar bag and squeeze as dry as possible, then mix it with commercial wall-paper paste of the consistency of thick starch.

For mountains, a frame is made and covered with insect screening, on which the pulp is laid. When dry it is painted moss green and daubed with brown and red.

The pulp may be modeled as desired. It goes well for hedges.—H. W. K.

State inspections show that:

Sout of Lears

NEED SAFER LIGHTING









RECENT figures indicate that the nighttime auto accident rate is still going up, while the daytime rate is going down. No wonder... when 3 out of 4 cars need safer lighting! When 3 out of 4 motorists are not getting as good lighting as they could get from the amazingly precise and efficient optical system provided by their headlights!



TAKE THIS EASY STEP for safer driving at night

Drive your car to a G-E MAZDA Auto lamp dealer and ask him for "Safety Lighting Service." This means:

- Cleaning lenses and reflectors
 which will bring you from
 to 150% more light.
- 2. Checking and aiming headlight beams ... to put light on

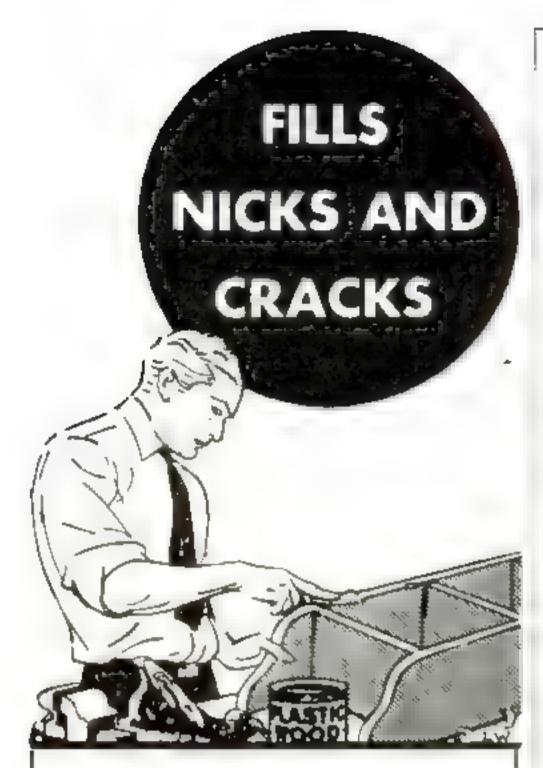
the road where you need it.

3. Replacing blackened or

3. Replacing blackened or burned-out bulbs with new G-E MAZDA Auto lamps, to give you better light for night driving.

Remember, G-E MAZDA Auto lamps are approved by all car manufacturers and are in most new cars when you get them. General Electric Company, Nela Park, Cleveland, Ohio.





Wood in Putty Form Makes 1001 Repairs

As it comes from the can or tube, Plastic Wood is soft and can readily be moulded with the hands, just like putty. When hard it has all the strength and properties of actual wood, except grain.

Plastic Wood is needed in every shop for

repairing broken furniture
damaged wood
tool handles
correcting mistakes
modeling
filling old screw holes, etc.

Plastic Wood will take and hold nails and screws firmly without splitting, can be planed, sawed, turned in a lathe, worked with any woodworking tools and can be sanded to a hair edge. It will not chip, splinter or crumble—is water-proof, weatherproof, and grease-proof—and takes paint, lacquer or varnish perfectly. Adheres to wood, metal, glass of plaster.

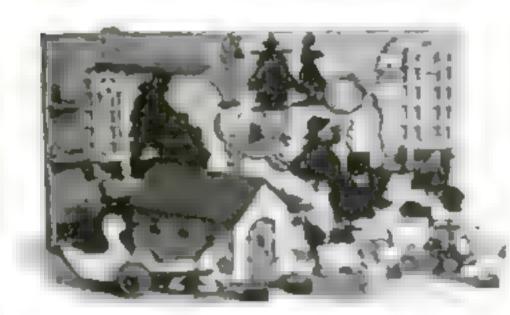
Get it at hardware, paint and 10¢ stores



Guild Members Show Great Gains

(Continued from page 107)

second annual handicraft competition of the Edison Homeworkshop Club, Chirago, Ill. Others winning prizes and their projects follow: J. L. Williams, modernistic end table: O. L. Anderson, set of walnut dishes; L. F. Holstein, sewing cabinet; E. M. Dittmer, inlaid tilt-top table; L. H. Juhnke, myrtle-wood fruit bowl; C. F. Wetzel, wooden inlay pictures; G. C. Baileys, carved wooden figures. Francis D. Bowman, of Niagara Falls, N.Y., awarded the prizes and showed a five-reel moving picture, "The Story of Abrasives." Judges were F. E.



Toys by Dr. Wright B. Lee, Eugene, Ore.

Gridley, W. S. Scribner, Ray Fenton, G. W. Adrianson, R. O. Johnson, C. C. MacMahon, and H. Y. Clegg.

Officers of the Eugene (Ore.) Craftsman Guild are Dr. James D. Stewart, president; W. I. King, vice president; Dr. W. B. Lee, secretary-treasurer. On the board of directors are Clarence Crocker, M. F. Johnson, and Harry Wilson. Work made on the lathe and jig saw was displayed by C. D. Thompson, Victor Walker, and Harold Ayres at the annual meeting held in the basement

workshop of Mr. Etewart.

The annual social and shore dinner of the Brunswick (Mc.) Homeworkshop Club was held recently at Harpswell. Me. Five reels of moving pictures were shown. . . Lawn chairs, a bird house, nail box, tool rack, bulletin board, and twelve picture frames have been made by the Beach (Va.) Workshop Club . . . Jean Tremblay of the Cartier Homeworkshop Club, Montreal, P.Q., Canada, is making a 12-in. model locomotive of wood from plans donated to the club by Georges Frenette, another member, who is now engaged in making a working jig saw of wood . . . Edward Gosselin displayed seventy-five wood samples at a recent meeting of the Ware (Mass.) Homeworkshop Club and spoke on building houses at another session. A filing box was the club's July project.

As its part in the city's "Golden Celebration of Oil and Gas," the Finding (Ohio) Homecraft Club assembled and painted six large flower boxes, which were placed on the railing of a new bridge. Recent meetings have included one-man exhibits by members, a talk on upholstering, a demonstration of letter and figure cutting on the jig saw, and a visit by the Toledo (Ohio) Home-

crafters.

Metal spinning and hammered work were demonstrated by J. F. Sherwin for the *Denver (Colo.)* Homeworkshop Club... The *Edmundston (N.B., Canada)* Hobbyists constructed a float that won first prize in the parade held in honor of the coronation of King George. Plans are being made for a

community workshop . . . Three members of the Muspeth (N.Y.) Hobby Homeworkshop Club have purchased screw-cutting lathes and made a working model of a 10-gauge salute cannon. Officers are L. Depose, president; F. Smith, vice president; E. Anderson, secretary-treasurer . . . W. M. Young, of the Manufield (Mo.) Homeworkshop Club, has completed a 12-ft, boat made of redwood. Several members have purchased cherry, walnut, and maple to dry out during the summer and use for projects in the fall . . . Copies of the program on "Safety in the Home Workshop" printed in a recent Guild bulletin were distributed to the North Shore Craftsman Club, Wankegan, Ill. Two moving pictures were shown. Club projects under construction are bird houses, camp stools, and lawn furniture.

The Middletown (Conn.) Homeworkshop Club lost one of its most active members recently through the death of G. L. Hoffman, last year's president. For the last few months the members have been busy fixing up new clubrooms. Business meetings are held twice a month and a work meeting every other week. New officers are James Henderson, president; Philip Hahn, vice president; Russell Halyburton, secretary;

Dr. Floyd Adams, treasurer.

To maintain interest during the summer, the Lakeside Homeworkshop Club of Muskegon, Mich., has announced that a prize will be awarded to the member who brings the best piece of

work to the first fall session.

Plans for an exhibition in the fall were discussed by the Society of Model Engineers, Ottawa, Ont., Canada, during a visit to the new shop of Adrian French and E. J. Sladden, who recently moved to Val Tetreau, P.Q. Their various machines were inspected and demonstrated ... Arnold Friedenberg, of the Granica (Alberta, Canada) Homeworkshop Club, purchased a new lathe and circular saw and converted a model-T Ford engine into a suitable motor. Construction of a "snowmobile" was discussed at the home of G. Schile.



Corvings by David Lundgren, Waukegan, Ill.

Officers of the Hardwood Homeworkshop of Neenah, Wisc., are William A. Thomas, president; Paul Steinway, vice president; and George J. Runde, secretary-treasurer. A committee has been named to plan a membership drive and to obtain a movie projector for the club.

The Cornhuskers Workshop Guild of Springfield, Ill., has changed its name to the Ideal Workshop Club. A successful exhibition was held recently in a hardware store window. R. E. Jess has completed a loom 3 ft. long which he built with hand tools and without a drawing or pattern to work from.

Fourteen (Continued on page 115)

Guild Shows Great Gains

(Continued from page 114)

members of the Homecraft and Model-makers Guild of Richmond, Va., were guests of the Capital Homecraft Club of Washington, D.C., at a dinner given in a Washington hotel. This was followed by a meeting in the shop of Andrew W. Bennett. Joe Chlopicki demonstrated wood turning and George A. Simonds explained how to make pictures of inlaid wood. Some of the members exhibited various projects they had made.

Delbert Barclay has been elected president of the Oklahoma City (Okla.) Homeworkshop Club, succeeding W. H. Reilly. A. J. Sprague was retained as secretary. Capt. R. R. Haley and Lieutenant Springer explained the activities of the CCC at a recent meeting, and refreshments were served . . . Forty members of the Jacksonville (Fla.) Homeworkshop Club heard a talk on California redwood. The Jacksonville Day Nursery showed moving pictures of the schools and of projects made for them by the club. Five new hand-and-eye coordination boards were presented to the nursery . . . A wood-turning demonstration and moving pictures of fishing were shown at a recent meeting of the Club des Artisans Amateur, Trois Rivieres, P.Q., Canada.

Talks on tool making, pattern making, wood finishing, and the like are planned by the Montgomery (Ala.) Handicraft Club. At the initial meeting of this new club A. L. Norris exhibited a violin he had made. All the members have agreed to donate home workshop books and magazines to start a club library.

The designing and cutting of inlaid pictures was demonstrated by M. F. Johnson and Carl Blood at a meeting of the Eugene (Ore.) Craftsman Guild at the Eugene High School industrial arts shop. Odine Mickelson showed how to use the lathe, cut-off saw, jointer, and handsaw and stressed the safety measures to be employed. Several guests from Portland attended.

Guild Offers Free Bulletin on How to Start a Club

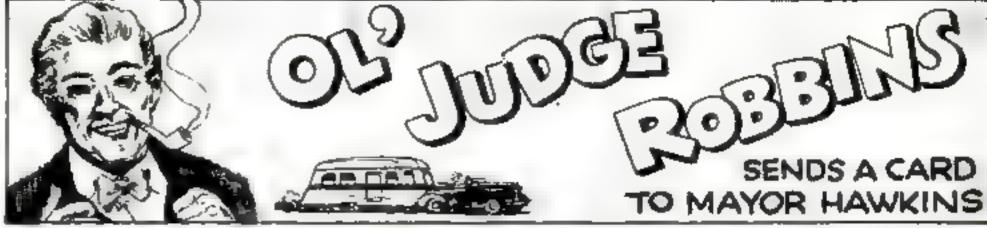
Now is the time to start planning your fall and winter activities. You will undoubtedly spend considerable time in your home workshop, so why not organize a club and join the National Homeworkshop Guild?

The Guild has outlined plans for the coming season that will interest you and your neighbors. To assist you to get a club under way, the Guild has a special free bulletin giving full particulars, which will be sent to anyone sixteen years of age or over.

National Homeworkshop Guild 347 Fourth Avenue, New York

Yes, I know several craftsmen who will help me start a home workshop club in our neighborhood. Please send by return mail all the necessary information teiling how I can organize a successful club and obtain free membership in the Guild. Inclosed is a large (legal size), self-addressed envelope bearing a three-cent stamp for your use in sending me this material.

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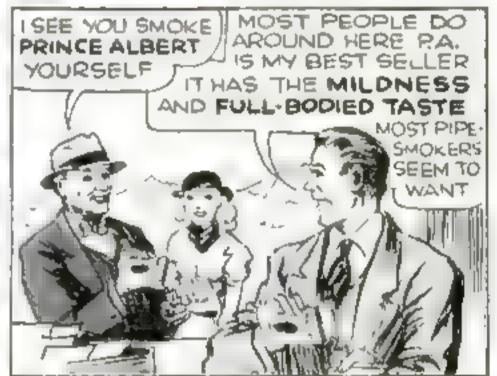




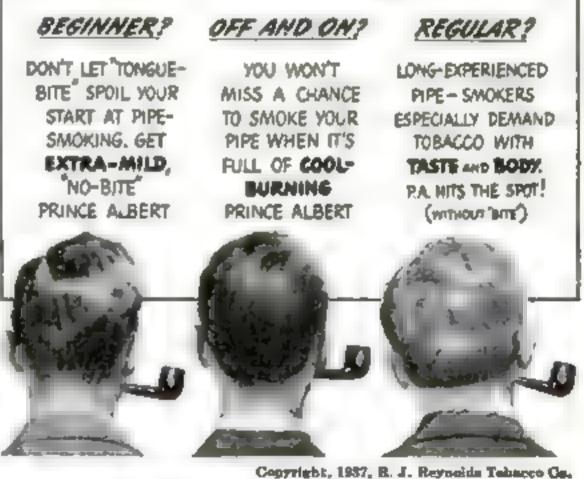








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Complete information, including sketches and drawings, is given in each pamphlet, but you will find it to your advantage to purchase the blueprints also in order to see the details more clearly. Blueprints for ship models are full size.

The prices of blueprints and instructions for some of our ship models and boats are given in the list below. Instructions can be purchased separately for 25 cents for those marked with an asterisk (*). A complete list of blueprints will be sent upon receipt of a stamped and selfaddressed envelope.



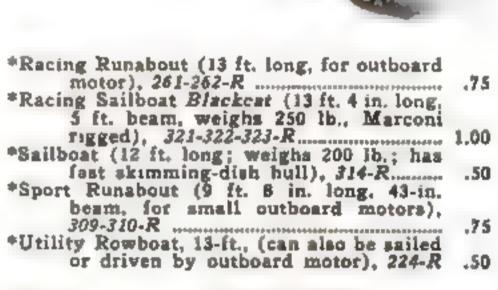
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*Privateer Swallow, Baltimore clipper, (13-in, hull), 228-229-230-R	1.00
*Racing Yacht Seascout (42-in.), 106-107-R *Roman Galley (19-in.), 138-139-R Ship Model Weather Vane, 66,	.75 .75 .25
*Sovereign of the Seas, clipper ship (201/2- in, hull), 51-52-53-R *Stagecouch with Horses, 144-145-146-R	1 00
Trading Schooner (171/2-in, hull), 252-253 *U. S. Battleship Texas (3-ft. hull), 197-198-	1,00
*Viking Ship (20½-in.), 61-62-R	1,00 .75
151-152-153-154 Yacht Rainbow (71/2-in. hull), 233	1.00 .25
(Construction kits are available for	

some of these models. See page 21.1



ı	BOATS	
	*Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-	
	193-194-R	.OU
	Camper's Utility Boat (11 ft, 2 in. long,	
	canvas-covered, for outboard motor	
		.50
	Canvas-Covered Duck Boat (13 ft. 6 in.	
	long), 279-R	.50
		.50
	High-Speed Boat for Small Outboard Mo-	
		.50
	16-ft. Motorboat-Rowboat (has decked	
	hull; for use with outboard or inboard	
		.50
	Outboard Racer for Class "A" and "B"	+
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Motors, (10 ft. 4 in. long), 211-212-R .75





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Amateur Short Wave Receiver, 155	2:
One Tube (battery operated), 103 Screen-Grid Set, 109 Short-Wave Converter Unit, 137	.2



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Maria The	With the state of	.25
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How to Construct a Portable Spot Welder at Low Cost

The copper tips should meet perfectly, because a variation in either the upper or lower arm would throw them com-

pletely out of line.

A %-in, laminated lead, secured to the channel iron by means of fiathead brass machine screws, extends several inches beyond the end of the iron, where it is connected to the remaining secondary lead with flexible braided copper, 1/4 in. thick, such as is used for connecting brushes on large generators. This can usually be obtained from motor repair shops, but if it is not available, the top lead may be continued in a large loop to the secondary coil.

THE upper electrode arm is secured to the flat steel angles by means of a 3/16-in, threaded rod, which also serves to hold the pressure arm in place. The pressure arm consists of an additional piece of 14-in. channel iron, 16 in. long, drilled and shaped as shown in the detail drawing. The flat portion of the channel iron is removed for a distance of 2% in, after which the end is shaped and drilled as shown. A piece of 14-in. round steel is attached to the pressure arm where indicated. Additional holes may be drilled in the sides of the arm so that the position of the round steel piece may be moved to change the leverage. Drill a wood handle to slip over a 1/2-in. round iron rod, which is secured to the arm with rivets or machine screws.

An automobile valve spring with a %in. pipe cap to hold it in place provides the tension for the upper electrode arm.

(Continued from page 99)

A %-in, machine bolt, 1 in, long, should be threaded into the bottom of the pipe cap and inserted into a hole in the wood top. Several holes should be drilled in the top so that the spring may be moved to change the tension. Valve springs from small cars fit the pipe cap very snugly, and with the springs from larger cars it may be necessary to remove the

threads from the pipe cap.

The copper tips are secured to the upper and lower arms by means of 4-in. brass machine bolts. If only the current carrying capacity were considered, the copper tips would not need to be any larger than the laminated copper lead. However, considerable heat is generated at the point of contact so it is advisable to make the copper tips larger to assist in dissipating the heat. The tips should be tapered to a 1/8-in. point, and since they wear away when in use, they should be removed from time to time and retapered. The ends of the tips should be kept clean and flat, which may be accomplished by filing between the points with an ignition file.

Since the amount of current required will vary with the thickness of the pieces of metal being welded together, some means of regulating the current through the primary of the transformer will be necessary. The reactance coil described with the arc welder, (P.S.M., July '37, p. 87) will allow the current to be varied over a wide range and it may be used with the spot welder without any

changes. Like the arc welder, the spot welder may be used on either 110 or 220 volts, alternating current. The wiring diagram shows how the coil terminals are brought out to the terminal strip so that they may be used in parallel for 110 volts, or in series for 220 volts.

When using the spot welder, the two pieces of metal that are to be welded are placed on the point of the lower copper electrode, and the upper electrode is brought down against the upper piece of metal. Since the conducting path between the metals being welded offers a high resistance to the current flowing from one copper tip to the other, the area around the copper tips will quickly come to a white heat. Further pressure will make the metals fuse together, after which releasing the pressure on the arm will cause the copper electrodes to spring apart.

TO MAKE a satisfactory spot weld, the metals should be clean and free from scale, and be of material that has a higher resistance than copper, such as iron or steel. Copper could not be welded satisfactorily because there would be a tendency for the copper to fuse with the electrodes. The operator should experiment with various kinds and thicknesses of metals until he becomes familiar with the amount of current and the pressure required for any kind of weld.

In a following article, Kendall Ford will give a number of hints on the general technique of are welding.



"This Close Shave," says Zane Grey, "Should Make Every Motorist Think Twice Before Gambling on Tires."

*THERE is one motoring mishap that the best of drivers cannot forecast. And it caught Edward Zachary of Hartford, Conn., completely off guard. He was whizzing along the North Ford road at a good clip when BANGthe right front tire blew out. An uncontrollable drag yanked the car smack alongside of a guard-

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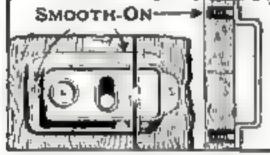
FASTENING SHELVES

masonry with a cold chisel, insert bolts with heads in to form studs, and tamp remaining open spaces full of Smooth-On No. 1. Let the Smooth-On harden, then slip the brackets, cleats or uprights over the studs and fasten with nuts or nuts and washers. A 1/4-in. bolt set this way holds a man's weight without

loosening. Use this method to anchor cellar shelves, partitions, wall cabinets, etc. Makes a strong permanently tight connection that meets every need.

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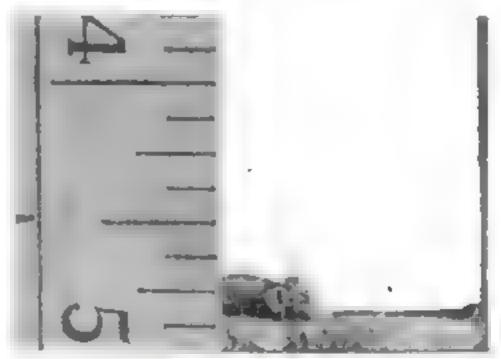
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Photographing Secrets of Insect Life

(Continued from page 66)

actual truth is that every ray of light that strikes the lens outside of the picture finds its way to the negative and causes a definite amount of fog! For instance, suppose you are using a white background as you shoot through the cage, and that, on the easel, this background will cover a space of five by seven inches or less. And suppose, for the sake of convenience, that you pin up a white card eleven by fourteen inches or more, as I used to do. Then every square inch of that superfluous, glaring white border, outside of the required five by



An easy and accurate way to figure magnification is to stand a ruler against the face of the cage before adjusting the camera bellows

seven inches, will cast its bit of flattening fog over your negative. The light
rays from this white surface will strike
the outer areas of your lens and be refracted to the inner surfaces of your
bellows; some of them will be reflected
onto your negative.

There are many other possible sources of flattening fog. Glossy, light-colored walls and ceilings are bad foggers. The light from the wall in front of your camera also enters the outer areas of your lens and adds its quota of fog as just explained. A little, even, of the light from the wall back of your camera hits the front of the insect cage and is reflected directly or indirectly onto your negative. And, of course, the photographing light must be kept far enough to the side so that no part of the reflector or the light can be reflected back into the lens.

DUT all this possible fog can be elim-D inated or reduced to a negligible minimum. The background easel can be covered with black cloth and the white background, when required, can be kept down to the smallest card that will cover the background of your picture. The front of the camera also should be masked with a piece of black cloth with a hole cut in the middle for the lens and shutter. Black outing flannel is cheap and serves as well as black velvet. A lens hood made of black paper, fitting snugly over the lens, is helpful in shutting out unwanted light rays, but it often is necessary to place a shield between the lights and the lens, as well.

As for the walls—the ideal studio for this kind of work would be a darkroom, painted and calcimined in flat black. If circumstances forbid such treatment of the room, a smaller, inner room can be constructed by hanging black cloth curtains around the work bench.

I realize that many workers will scoff at some of these as unnecessary precautions; nevertheless each one of them does its bit towards the elimination of fog, and the producing of brilliant negatives—and so is well worth the trouble involved. Quite recently I had my own storeroom calcimined in dark brown, and it made such a marked difference that my negatives were too contrasty, and I had to reduce my time of development. Obviously, this was because over-development was no longer necessary in order to kill the flattening effect of the fog I was getting from white walls.

DUT to go back for a moment to the D photographing cages. It is quite true that glass cages increase reflection danger, especially when you are using dark backgrounds, but their advantages more than compensate for this. By shooting through these cages, all distracting background shadows are avoided. And by having a selection of cages of various depths for insects of different sizes, everything within the cages is always in focus. Whether you are working with open cages or "glass-windowed cocoons," each specimen feels at home and can be set up and shot at a moment's notice when anything interesting is about to happen. You are photographing real, natural life, with a "candid camera." And, when important developments are expected in some such secret chamber, the cage can even be left on the stand, in exact focus and ready to shoot instantly if necessary.

Patience and persistence also are important units of equipment. Sometimes you will have to wait for hours to get the shots that you want—and then, perhaps, do it over and over again until it is right. In some cases, you will have to wait weeks, or months, or even a year, for the right season, to get a single shot to complete the life history of a certain species. An exceptional case is that of my Black Widow series, which was three years in the making. So it is a good idea to work with several species at the same time. Then you can avoid the long waits and there will nearly always be developments to keep you busy.

Streamline Mine Shafts Cut Ventilation Cost

STREAMLINE mine shafts have been proposed as a means of cutting down the cost of ventilating coal and iron workings. Based on present knowledge of air flow and wind resistance, it is estimated that the power required to make a volume of air turn a right-angle corner, such as is commonly found, is as great as would be needed to move the same air through a straight, concretelined tunnel 485 feet long. If the rightangle corner were rounded as proposed, it would create much less resistance equal to only twenty feet of straight, smooth tunnel. Rounding off one or two corners in a complicated mine would, of course, be of little importance in reducing the ventilators' power requirements. The opposite extreme, lining all tunnels and shafts with smooth concrete obviously would be impractical. It is held, however, that judicious planning of the workings, with carefully worked out placing of the timbers that support tunnel roofs, would effect worthwhile economies in mine ventilation.

How's Your Reading?

(Continued from page 37)

the retina of the eye, accounts for the phenomenal ability of the fastest reader yet discovered—an eight-year-old boy who can read comprehendingly almost

2,000 words a minute!

Contrary to the long-standing belief that a person sees from four to eight words at a glance, the average person takes in less than two words at a time. Only one subject out of 3,000 could recognize more than six words at once. A normal person's eyes hover for a fifth of a second at each stop on a printed line, and leap to the next one literally quicker than a wink, as speed tests have shown. A wink takes one-fortieth of a second, while the eye movement requires only a hundredth of a second.

You can speed up your own reading rate at home by this simple method: Read easy, interesting material rapidly for a few minutes at a time, then record your speed in words to the minute, and answer questions like those below to be sure you understand what you have read. Practice often, but only for short periods at a time, and keep a record of your speed and comprehension. This will help you become a more rapid

and efficient reader.

READING TEST

Place a check mark beside either Yes or No to indicate whether the following statements are true or false. Take as much time as you need. When you have finished, refer to the test paragraph on page 37 to see how many you got right.

1. New precision instruments for the gravity tests were designed by a Belgian scientist. Yes No

2. Three days were required to conduct the experiments. Yes No 3. Twenty observations were made during the tests. Yes No

4. One of the experimenters represented the U.S. Coast Guard. Yes No

5. The Empire State building is 1,258 feet high. Yes No

6. This is the first time that such gravity tests have ever been made. Yes No

7. Three scientists conducted the experiments. Yes No

8. Results will probably show that a man weighs more at the top of a building than he does at the bottom. Yes No

9. The tests were made in a passenger elevator. Yes No

10. One of the scientists represented Lehigh University. Yes No

If you got nine right, your comprehension of the contents of the paragraph was excellent. Eight right is good, seven fair, six poor, and five or less bad. Divide the number of seconds it took you to read the paragraph into 6,000. The result will be your reading speed in words a minute. A high comprehension mark, together with a good reading speed as shown in the table below, will indicate that you are probably an efficient reader.

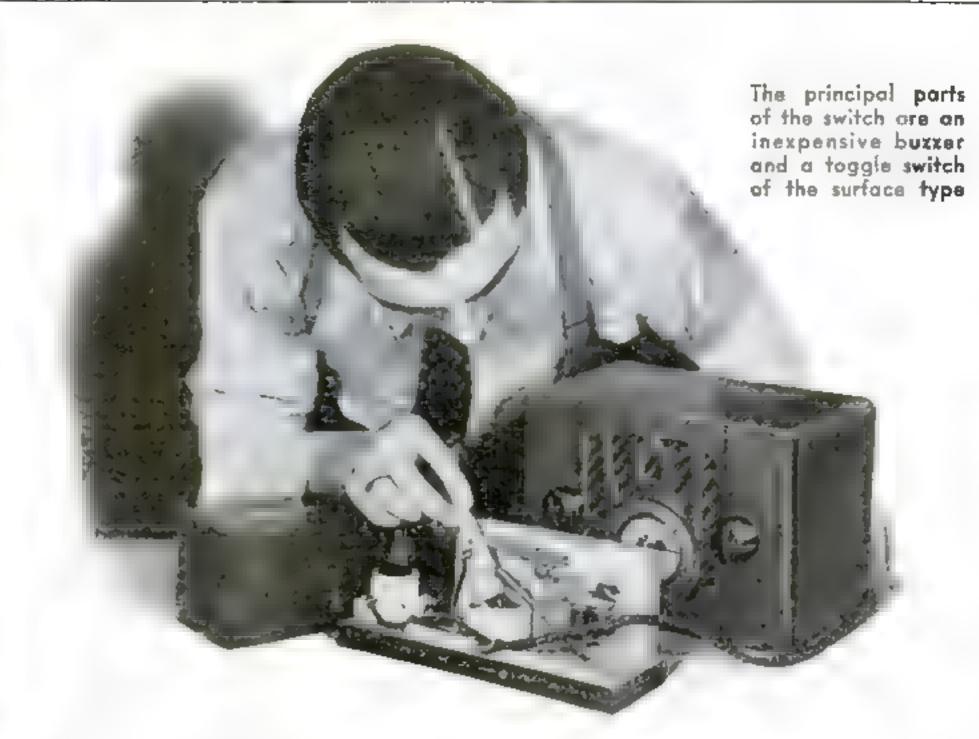
	Excellent	Good	Fair	Averag	e Poor
Reading speed in words a minute	and over	275 to 350	225 to 275	150 to 225	150 and under



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SWITCH for Use with ELECTRIC TIMER

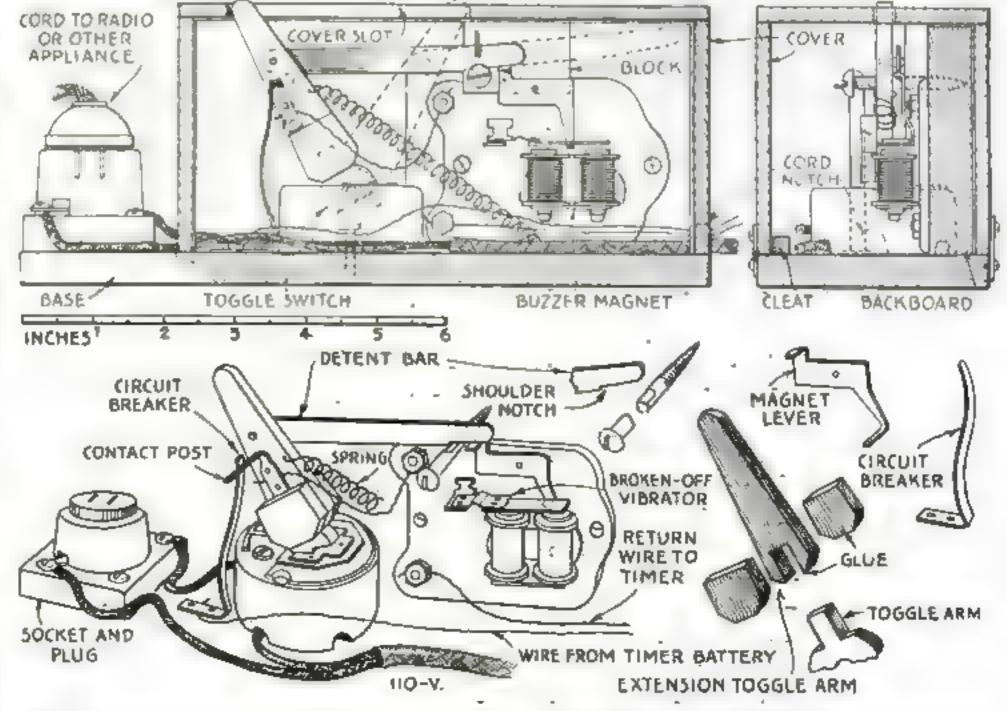
of an ordinary buzzer, this easily assembled switch for 110-voit current serves either as a remote-control switch or as a clock-controlled switch for use with an electric timer such as that described in a recent issue (see P.S.M., Mar. '37, p. 85). It will turn on the current for a radio set, lamps, a furnace regulator, or any electrical device.

Two flash-light cells are sufficient to energize the magnet, which draws down the broken-off vibrator of the buzzer and by means of the pivoted lever lifts the so-called "detent bar." As the bar is lifted, it is freed from the large wood screw, which is squared at the point of contact to serve as a catch. The coil

spring then pulls the extension lever on the toggle switch, thus operating the switch. At the same time a small contact post on the extension lever moves away from a flat spring contact and breaks the flash-light battery circuit.

After use, the switch is reset by throwing the extension lever back, which
causes the detent bar to catch on the
screw and also again closes the battery
circuit through the contact post and flat
spring.

The switch itself is an ordinary toggle-type surface switch with porcelain base, and a standard-base porcelain receptacle with an outlet plug is used for plugging in the radio set or other device or circuit.—J. D. GARFIELD.



The assembled switch and sketches showing its construction and the method of operation

High-Power Model Plane

(Continued from page 92)

ing spar. Although for clearness the upper spar is shown in the drawings, it is advisable to start with the lower one.

After spars are cemented, make the tips. First cut the sheet balsa to outline and cement it in place. Then notch spars for the bamboo strip, which is cemented first to the leading edge, and arrer it is set, rolled around the balsa cheet to the trailing edge. Cut and sand the tips smoothly before covering.

THE two haives of the wing are assembled with care to have the correct dihedral and even incidences. Note reenforcement pieces in center joint. Cover leading edge, top and bottom, with 1/64-in, "C" grain balsa. Sand to form an evenly tapered overlap. Notice how spars are slightly below the camber line to allow for the balsa sheet.

Tail surfaces. The ribs are tapered after assembly. The bamboo tips are bent over flame or heat. Make an extra wide tip for the stabilizer and split it in halves after it is formed. Especially note how rudder is fixed to stabilizer, and also the thin aluminum strips that hold the adjusting tab at whatever po-

sition it is placed.

Propeller. Use fairly hard balsa, First drill shaft hole, then cut to exact blank dimensions. Carve lower camber and finish it completely with knife, then by rough sanding, and finally with 10/0 sandpaper. The upper camber is carved next and finished. Cut blades to outline and finish carving the thickened portion exposed while outlining. Coat propeller with one layer of clear dope, and sand. Attach shaft bushing or tubing and the free-wheeling device. The free wheeler used is a commercial one, but another simple type that can be made at home is also shown. Bind and cement it securely. Cover blades with silk and apply four coats of cement with sanding, and a final coat of silver dope.

THE propeller shaft has a special safety hook. The rubber tensioner is optional: its purpose is to prevent the last few turns from unraveling and so keep the rubber from sagging.

Papering. The color scheme is yellow wing and stabilizer, and silver fuselage and rudder. The fuselage is covered twice with the paper grain crisscrossing for extra strength. After a mist spraying, apply two coats of clear dope to the wing and a coat of silver dope to silver paper used on fuselage and rudder.

Flying adjustments. On the original model the trailing edge of wing was just above the rear wire struts. The tail setting was zero, as was the thrust line. The rudder was set for a right turn, against the torque. If you have any spinning trouble, set the thrust line slightly down and to the right, and take out the rudder adjustments until the spin is removed. Also check for possible warps on

wing and tail.

Duplex conversion. This design can be easily converted into a contest tractor by building the motor stick as shown. Notice how the nose of the stick is made to take the hardwood plug. This allows the fuselage propeller to be used without removing the rubber from the shaft, and makes fast changes possible. You will have to use much more down thrust on it, and also bring the center of gravity closer to the one-third point of the chord.







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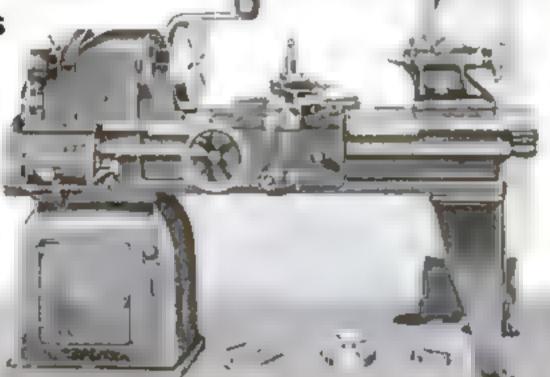
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IVER JOHNSON'S ARMS & CYCLE WORKS Established 66 years

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No More Polishing!

(Continued from page 100)

and in what manner the lacquer will be brushed on so as to avoid any touch of the fingers, which would inevitably show up some months later as a brown print beneath the lacquer.

Brushes for applying metal lacquers should be single thick rather than double, and of the softer fitch, bear, or oxhair types rather than black China bristles. They should be wide rather than narrow. Remember that brushing lacquer dries faster than any other paintshop finishing material which you have used thus far, and hence plan your operations accordingly. Lacquer must be applied with an easy, flowing stroke from a not-to-full brush; and repeated strokes over the same area are to be avoided.

NOTE in one of the illustrations how the small Chinese vase is held between the thumb and middle finger so as to permit free and easy stroking of the lacquer around the brass, and yet avoid touching the polished surface. Note also that the wide-bowled ginger dish has been unscrewed from its column and base so as to facilitate easy handling. All this work of lacquering is done on a fresh sheet of clean wrapping paper to avoid lint or other fine dust, while the brush itself has been carefully washed in clean denatured alcohol and then dried by snapping the bristles downward while the brush is swung at arm's length.

In applying lacquer to bowls or ash trays, turn them over on to two clean sticks; apply the lacquer with circular strokes to the underfaces, let dry, and then reverse to coat the inside areas. Stroke from the center outward in order to avoid any "fatty" edges.

In the case of turned Colonial brass candlesticks, separate them far enough so as to permit working around them, and hold them steady by pressing the eraser end of a pencil down in the cup while brushing the lacquer around the columns. On the bases, if square like those shown, use a short stroke from the center of each side directed right and left towards each corner, not from the corners, in order to avoid any possible sags or drips. In all this work have the brush partly full but not dripping so as to apply a wet and free-flowing coat which will level out by itself without any rebrushing over the same area.

Pieces like the tall, square, antique Chinese tea urn shown in another view present brushing problems that must be carefully thought out. By lacquering all the square body first, then the spigot, the slip cover, and last of all the split handles, the job was readily handled. So, too, were the butterfly-pattern saucers for the rice-pattern cups and the heavy, removable trays.

A hanging copper ivy bowl requires a high polish. The ivy can be tied up out of the way while the bowl is being lacquered.

For over five years the brass in my own home has remained bright and unspotted; indeed it looks as if it is going to stay that way forever. Polishing brass so far as I am concerned, is a task relegated to the attic of forgotten memories.

SUBSCRIBERS are requested to notify us of change of address four weeks in advance of the next publication date.

A New Bedford Whaleboat Model

(Continued from page 105)

neath, this has holes in it for spare chock pins. This forms the box, in which is coiled some slack whale line.

At the after end there is a platform (cuddy board) on the gunwales. On this is a fore-and-aft board called the "lion's tongue," sometimes shaped as shown by the dotted lines; through this is cut a square hole for the shaft of the loggerhead, the lower end of which goes through the footboards. At the forward edge is a roller between two cleats; on this the mast travels and rests when being placed with its heel under the after thwart to make room for handling the whale line. On the cuddy board there is also the steering-oar brace-a crosspiece with an upright let into it, each with a hole in the end.

The forward ring for the davit fall goes through the middle of the clumsy cleat, and the other is the same distance from the stern. I made these of copper wire to go through the keel, where the ends are snipped off and burred

with the hammer.

Inside the boat are peak cleats for each oar. These have holes large enough to take the oar handles and are placed directly across from the oarlocks, at an angle so that the oar handles will go in them when the oar is in the oarlock with the blade peaked up. There are cleats (or steps) on either side aft, at the thwart level, for the helmsman to stand on when handling the steering oar.

Belaying cleats are needed here and there as shown, and lead cleats on the gunwale to catch the line if it slips from the stem lead. A cleat for the harpoon crotch is required inside the gunwale, forward of thwart No. 1, to starboard.

Rowlocks are set in wooden cleats on the gunwale; these are 12 in. abaft the edge of their respective thwarts. There are three to starboard and two to port.

Thimbles are grommeted or strapped to the gunwale forward for the jib sheets and one aft, to port, to which to fasten the loom of the steering oar when not in use. In the forward port chock there is a diagonal cut, used to straighten lance shafts.

Outside, the boat is white except the top, or first two, strakes, which are black. Inside it is gray, or colored, up to the thwart clamp. The thwarts and all above are white.

(To BE CONTINUED)

How to Whiten Sport Shoes Without Smudging Soles



White shoes can be cleaned without smudging the edge of the sole by using the device illustrated to apply the dressing in the recess just above the sole. It is made of flat aluminum, cut and bent so that a strip of cloth about 2 in, wide and 3 in. long may be folded in two lengthwise and threaded through the slot for about an inch. The remaining end is folded loosely into a pad, which is pressed against the shoe by the thumb, as shown.—James E. Polisso.

List of Materials

SOFT PINE

No. For Dimensiona Pe. 1 455"x3"x14" Hull 1 1"x2"x3" or scrap Tubs, etc.

SEMIHARD WOOD

1 1716"s >"x1114" Keel 2 3/32"x3/32"x14" Gunwales 4 1/16"x1/16"x13 /2" Moldings 2 18"x 8"x12" Thwart clamps

THREE-PLY OR OTHER WOOD 1 1/16"x7"x9" Ceiling, thwarts. (or equivalent) platforms, trunk, paddles, etc.

BIRCH OR SIMILAR WOOD

1 3/16"x14"x50" Oars 1 12"x 14" dowel 1 50"x 18" dowel Mast Sprit, gear handles, etc.

MISCELLANEOUS

Cardboard, 2"x8", for ribs. Thin metal, 1"x21/2", for centerboard. Thin tin 2"x3" Brass tube, 3 32"x 44", for boat hook. Soft iron rod, 3 32"x1" for harpoons, Cord-18-thread, 4 yd., 15-thread, 4 yd.; thin, 2 yd

Sailcloth, 12"x14". Red material for flag. Wire. No. 20, 22", No. 30, 12", No. 18, copper, 4".

Five No. 3 sewing needles. Spline, or bamboo, 1/8"x1/6"x1", for barpoon crotch

Small nails, pins, glue, black and white paint, varnish

Blocks, 3/16", 2.

Home Improvements for SEPTEMBER

EVEN the most carefully built home requires attention periodically. Never wait too long to make those needed repairs and improvements. Some suggestions for September follow:

Correct defective fireplaces, Install humidifying apparatus, Clean out clagged drains.

insulate garage and construct floor. Make several extra sets of keys for all ocks.

Repair roof flashing to prevent leakage. Install additional bells for convenience. Repair or replace cracked cement floor, Build gate at head of stairs to safeguard children.

Install ceromic tile floors or wainscots in bathroom or kitchen.



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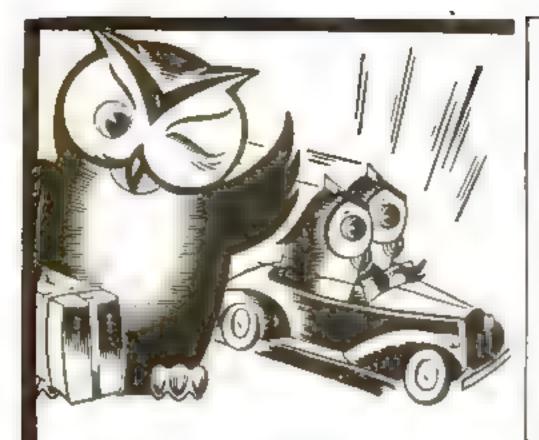


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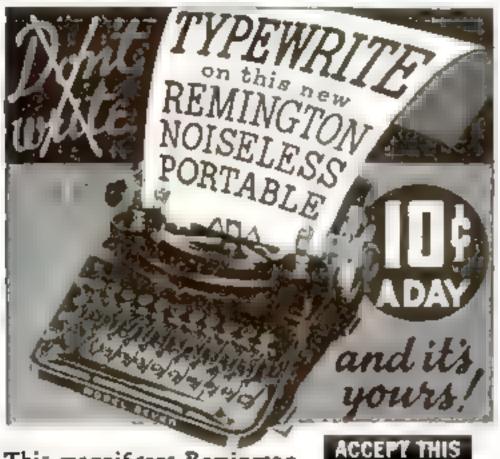
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a fair Fourth Ave.

Inlaid Checkerboard

(Continued from page 103)

LIST OF MATERIALS

MAPLE

Pc.	T.	\mathbf{W}_{*-}	L.	Description
3	1/8	15%	14	White squares
1.	1/8	136	14	White squares
6	3/16	3/4	6	Border inlay
4	1/4	3/4	11/4	Inlaid butterfly keys

THREE-PLY MAPLE PANEL

131/2 131/2 Mounting board for squares

WALNUT

				_
4	13/16	11/2	161/2	Frame
3	5/8	156	14	Black squares
-1	1/8	176	14	Black squares
6	3/16	3/4	6	Border inlay
Æ	1/4 dia.		10	Dowels for corner
				ioints

MISCELLANEOUS

1/16 3/8 13/8 Brass for hanger 1/2-in, No. 4 Brass wood screws for hanger.

Note: All dimensions are given in inches and are finished sizes.

MATERIAL COST TO AUTHOR

Walnut, 2 ft. b.m. (board measure)	
at 55 cents	\$1.10
Maple, 1 ft. b.m. at 15 cents	.15
Maple panel	.40
Brass, screws, filler, and varnish	.35
	62 AA

Approximate hours labor (estimated) 13

glued to 4-in. plywood mounting board. Instead of following this method, the playing surface could be made of individually cut squares, but great care would have to be taken.

For the inlay of the border, glue up six pieces of walnut and six of maple with their ends staggered at 45 deg. Strips can then be cut off on the circular saw with the angle guide to the exact width. These inlays should be set into the frame before it is fitted onto the board. A dowel through the mitered corners of the frame will provide a sufficiently strong joint, but further strength can be supplied by inlaying double butterfly keys as indicated.

The hanger is made of a strip of brass screwed across an oval hole.

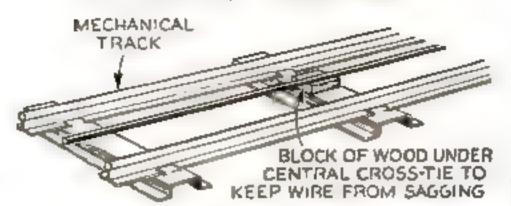
The board will probably look best if it is given a rather high polish, the grain being filled with paste wood filler or shellac and well rubbed down with pumice, then finished with varnish or wax .- ARTHUR COLLANI.

List of Materials for Coffee Table

(Described on page 103)

,		4 0	
No. Pc. Descriptio	n T.	w.	L.
1 Top (plywo			
glued up fr stock)	om solid ¾	14	26
2 Crosspieces	3/4	11/2	10
2 Posts	134	134	10 3/16
4 Cross feet			
(glued toge	ther		
in pairs)	3/4	see d	lrawing
2 End feet	3/4	31	11
l Stretcher	3/4	17/16	111/4
Note: All di	mensions	are in incl	bes and are
finished sizes.			

Reducing Cost of Track for Model Railroads

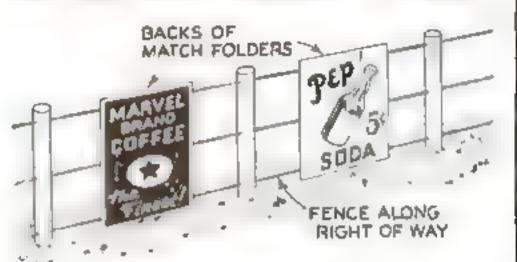


How the cheap mechanical track is altered

Model railroaders who use commercial tin-plate track can stretch their track dollars considerably by buying one section of the much cheaper mechanical track for each section of electric track. The sections are alternated, and a stiff wire is added to the mechanical track to carry the current. I use clotheshanger wire after removing the paint.

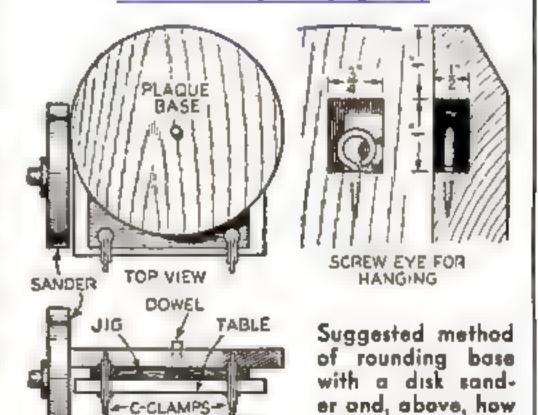
Miniature Fence Signs

Rolling along in a Pullman, one often sees signs attached to the fence that incloses the right of way. Similar signs for a model railway may be obtained by taking them from the backs of match folders. Most of the advertisements are the right size for O-gauge.-B. BAKER.



Carved Indian Plaque

(Continued from page 89)



illustrated and finish the headgear before gluing it to the head. Carve the horn, paint it white, and glue it on the dowel after the headgear is in place.

SIDE VIEW

the plaque is hung

Shape the base of the plaque. A suggestion is given for a simple jig for rounding the base by using a disk sander, although the operation may be done in any convenient way. Color the bevel and edge by rubbing in a mixture of lampblack and turpentine, and polish by rubbing vigorously with a soft cloth. Glue the paper-thin veneer, if it can readily be obtained, to the base; otherwise, of course, the base may be veneered in the regular way or finished as desired. A screw eye for hanging the plaque is inserted in a mortise as shown. The head is then fastened to the base with dowels and glue.- Howard Reib.

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rounding runs 27 minutes on others of grace

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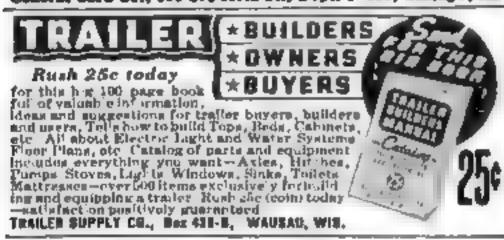
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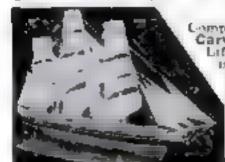
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Medical Miracle Men

(Continued from page 43)

a miracle was about to happen. For that reason, we set the stage as impressively as possible.

At the appointed hour, nurses and attendants crowded into the room, to stand about like movie "extras." A ponderous electrical machine, trailing heavily insulated wires, was wheeled forward. A nurse shaved the soldier's scalp. I adjusted electrodes on his head. It was hocus-pocus, pure and simple—but a man's future happiness depended on it! Our faces were solemn and tense as I eased on the current.

The apparatus crackled and hummed. Bluish sparks leaped into the air. The room was filled with the smell of ozone.

ONLY a small amount of electricity was reaching the patient—just enough to make his scalp prickle. "Now!" I cried, and gave the control knob a twist. A sharp stab of current made him jump. As I switched off the electricity, a nurse played the trump card. Through a telephone receiver she held to his ear came a feminine voice—that of the soldier's fiancée, in Chicago, whom he had secretly called by long distance to take part in the drama.

Something snapped within the man's mind. His countenance was transfigured with joy. "Sweetheart, I can hear you!" he fairly shouted into the mouthpiece as he seized the telephone. Romance and science had joined hands to accomplish his cure.

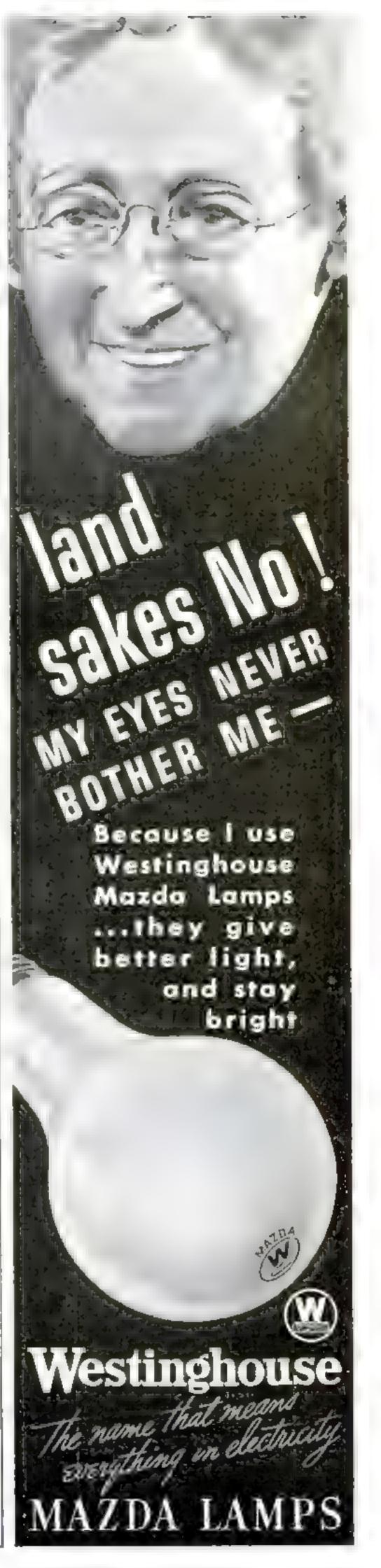
In all these amazing cases, you must keep in mind that the patient is not "just imagining," he is not "putting on," he is not malingering or faking. The effects are just as real as the physical maladies they counterfeit.

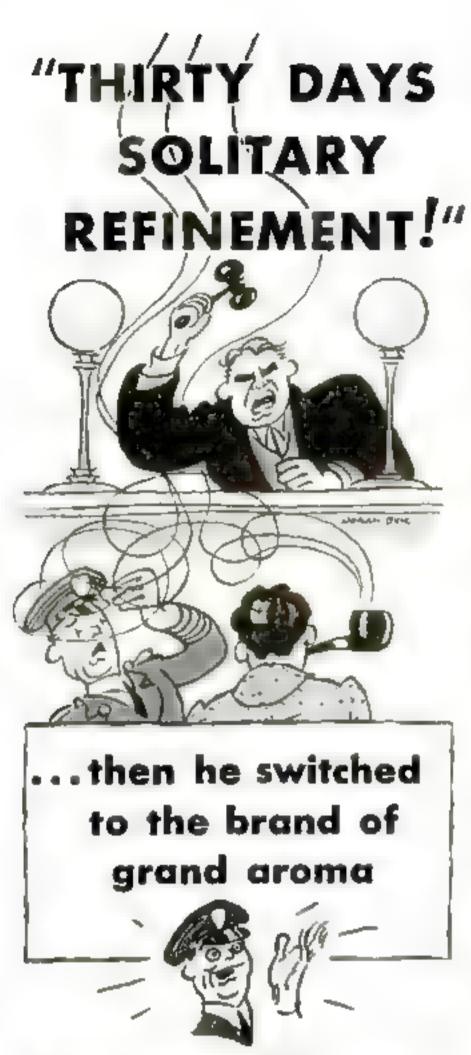
Often, the causes of these curious ailments are as strange as the remedies. Sometimes we have difficulty in bringing to light the origin of the trouble, because it seems so remote from the result it produces.

A woman complained of heart attacks that troubled her whenever she went out walking, though she was immune from them as long as she stayed indoors. It developed that while walking down the street, a few months before, she had come upon her husband strolling arm in arm with another woman. Thenceforth, without realizing it, she dreaded to leave the house for fear of again meeting her husband with her supposed rival—and the "jumping" of her heart was due to this mental kink rather than to physical exertion.

A young woman went blind because she couldn't stand the sight of her husband; a soldier's eyesight failed him after he had seen his best friend blown to pieces by a shell. A timid chemical worker became so obsessed with the fear of an explosion which might blind him that he found, one day, he could not open his eyes at all.

party made one woman's skin break out into a rash that lasted twenty-minutes or so. Red spots appeared on another woman's complexion whenever her family suffered financial reverses. A third developed inflamed and blistered hands solely from worry about a mysterious illness from which her husband suffered. When a specialist finally diagnosed the husband's malady as one that could be cured (Continued on page 126)





The charge: "Guilty of disturbin' the peace and violatin' the nostrils of decent people." The sentence: "Clean the gook out of that briar and switch to a fragrant, law-abidin' tobacco like Sir Walter Raleigh." The moral: Another good man goes right with mild Sir Walter! Only 15% a tin, and heavy gold foil keeps those two full ounces of Kentucky Burley fresh and sweet from the first to the last pipe-load. Well worth trying, wouldn't you say?



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Medical Miracle Men

(Continued from page 125)

by an operation, he hazarded the opinion that a successful outcome might help the wife too. His hunch was correct; just as he predicted, the husband's operation cured two patients at once!

More than 2,000 years ago, the Romans knew that a sudden mental shock can produce a goiter, or enlarged and overactive thyroid gland in the neck. Such a shock need last but a moment, we have found, to produce this effect.

TO FRIGHTEN her flancé, a young woman pretended to drink poison and fall unconscious to the floor. The man rushed in terror from the room, and did not learn until a week later that he had been deceived. By that time, the nervous shock had produced an over-active condition of the thyroid and he had developed a goiter. A Government inspector in a munitions factory, during the World War, had the same experience after he saw a freight train jump a track and plunge into a warehouse filled with shells, causing a terrific explosion. By attacking the problems of all of these patients through the mind rather than through the body, experts brought them back to normalcy and health.

Not long ago, a scientist at Yale University, Dr. Nathaniel Sherman, explained how the primitive shaman or medicine man achieved results in curing many kinds of ailments. By arousing the patient's emotions to a high pitch, he apparently brought about miracles of

"faith healing." Such things as cancer, hardening of the arteries, and other organic disorders, of course, are beyond the reach of mental cures. But in many dread diseases, such as tuberculosis, we are finding that the condition of the mind is a vital factor in recovery.

I learned this almost as soon as I started in medicine. One of my first patients was a beautiful twenty-twoyear-old girl who was under treatment for consumption at a sanitarium. She was making splendid progress when her fiancé broke off their engagement. Immediately she took a turn for the worse. Her fever rose, she lost weight steadily, the disease spread. Then her flancé bad a change of heart and returned to her. The effect was literally miraculous. She began to regain the weight she had lost, and soon her afternoon fevers left her. In six months the disease was arrested and she was married. Today she is a happy wife, taking full charge of her home.

Some day, medical men may be able to measure the physical effects of joy and sorrow, hope and despair. The interrelation of mind and body is a field of study that is receiving ever greater attention. Psychiatrists, the modern miracle men who bring sight to the blind, hearing to the deaf, and relief to the afflicted, are leading the way to a better understanding of this all-important border zone of medicine.

Custom-Built Knives

(Continued from page 60)

forty-eight inlay patterns for use on the handle of the knife. In addition to wooden handles, special jobs sometimes employ composition material or stag's horn.

Occasionally, a client will bring in a complete pattern for a knife. Thus, Col. Townsend Whelen, noted firearms authority, brought the design of an outdoorsman's knife to Wetherill, who made the finished product. This type of knife is now a standard item in sporting-goods merchandise.

THE largest knife Wetherill was ever asked to turn out was a machete nearly two feet long. It was made for an explorer to take on a South American expedition. The smallest of the workshop's products is a slender 6½-inch dagger known as a "pocket defender."

It was produced at the request of a traveler who was planning a motor trip with his wife through the interior of Algeria. He had intended to carry a revolver for their protection, but his wife vetoed the idea. He came to Wetherill for some kind of a protective weapon he could carry without his wife knowing it. The resulting knife has a clip and fits in an inner pocket like a fountain pen. The traveler wore the weapon throughout the journey. Although he had no occasion to use it, he felt safer for having it along.

Other orders for defensive fighting knives have come in from Mexico and South America. The most unusual of these has a wide, heavy blade almost like a cleaver. It is hollow-ground to com-

bine weight and keenness in the blade. The British manager of a frontier trading post in Paraguay ordered the strange weapon.

In making special designs for customers, Wetherill, whenever possible, "tailors" the knives to the physical "build" of the men who will use them. He takes seven measurements, including the length of the arm and the forearm, before he begins work on the design of the knife. Usually, he submits three or four patterns out of which the purchaser chooses one. When an exclusive pattern is desired—that is, one which is not to be sold to anyone else—an additional "design charge" of twenty-five dollars is added.

a "phantom" throwing knife for exhibition work and a "bulbous" bowie knife. The latter has a bulge near the end of the blade which strengthens the point where the tip is most likely to break off. The "phantom" has a slot running part of the way down the blade from the handle to aid in giving perfect balance.

As a field test for his throwing knives, Wetherill sometimes takes them along on hunting trips. He is an adept knife thrower, using half a dozen different tosses with equal ease. On two occasions, he has killed rabbits in the field and, last winter, while on a deer hunt in the Adirondack Mountains, he pinned a porcupine to a tree twenty-one feet from the ground.

Sheaths, as (Continued on page 127)

Custom-Built Knives

(Continued from page 126)

well as knives, are being improved at the Philadelphia workshop. Recently, Wetherill introduced a novel departure in the form of wooden cases for hunting knives. Another innovation is a sheath with a boxlike pocket at the top, into which the handle of the knife fits. Cross grooves on the handle keep it from slipping out of the pocket, even when the sheath is shaken upside down.

Note long ago, an Idaho sportsman ordered a sheath for a large skinning knife, with a special compartment for a taxidermist's scalpel on the outside. He wished to carry the scalpel for cutting around the eyes in removing the skins of animals. Several times, taxidermists have commissioned Wetherill to work up knives for special purposes, and two men who spend their time collecting specimens for large eastern museums have brought ideas which he translated into wood and steel to help them in their work.

Wherever Wetherill travels, he keeps an eye open for collections of ancient weapons. He has visited most of the museums of Europe and has even gone to the island of Malta, in the Mediterranean, to view the early arms which are kept there on display. In the West Indies, he has made some of his most interesting finds among pirate weapons. In a private collection at Bridgetown, Barbados, he discovered a knife which once belonged to Jean Lafitte, the famous pirate of the Caribbean.

By studying the work of old-time knife makers, and by applying modern scientific principles to individual requirements, he produces his new and improved designs.

IN HIS own collection of ancient weapons, Wetherill has more than 112 knives, swords, and spears. They include a Philistine knife said to date back to 2,000 B. C., and an Ethlopian dart hammered out of native iron. One of the most vicious weapons in the collection is a Spanish "hook dagger" from Toledo. The inner edge of its curving blade is sharpened so that it cuts on the backward stroke. Among them all, however, the place of honor is held by a simple and rather crudely made hunting knife with a straight and narrow blade. It is the horseshoe knife which started Wetherill on his career.

Even today, when he is not designing knives for customers. Wetherill is following his hobby: designing knives for fun.

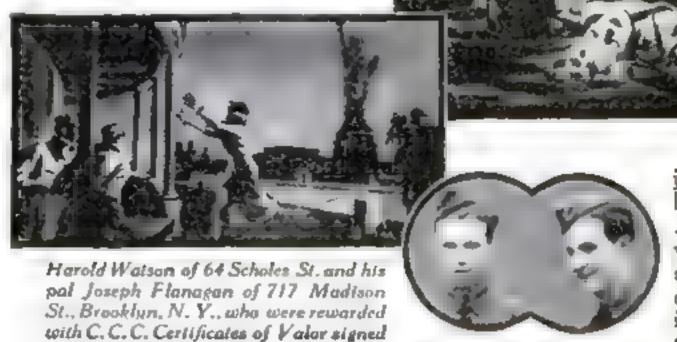
Aluminum Pistons Have Hard Surface Coating

HARD aluminum oxide, the chemical of which sapphires, rubies, and emery are composed, has been found in the form of a thin coating on the aluminum pistons of airplane engines by an English scientist. Using a novel camera that records the images of electrons, the discoverer found that aluminum pistons deyelop a hard, diamondlike coating of crystals that are able to score and wear the comparatively soft cylinder walls of gasoline engines. The coating is estimated to be about one millionth of an inch thick. Experiments are under way to coat the pistons with magnesium, to prevent oxide formation.

Black Swirling Water Swept Her Out of

Sight

Girl Leaps for Ferryboat and Misses: C. C. C. Rescuers Plunge Among Ice Floes



"A girl came running down the dock as the boat pulled away. She jumped... and missed," writes Harold Watson, "falling into the icy swirling water. Standing as I was on the deck of the ferry-boat with my buddy Joe Flanagan, I saw her swept under the pier while those on the dock couldn't tell where she was.

by President Roosevelt.

"One man had a flashlight but he didn't know where to shine it... I had to have it so I jumped back on the dock and dove after the girl with the flashlight in my mouth. I found her easy enough, but it was so cold in there amongst cakes of floating ice I couldn't do more than

iust hold her up. It looked like we both would drown ... I was ready to give up... when I realized Joe was shouting at me, saw him swimming toward us towing a life preserver. Thanks to him we got the life preserver under the girl and

brought her out from under the dock where soldiers in a life boat pulled us out.

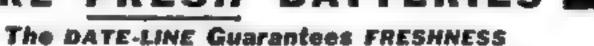
"But if it hadn't been for that flashlight and those fresh DATED 'Eveready' batteries that kept the light burning in that icy salt water, there couldn't have

been any rescue at all, for we never could have found the girl under that dock.

(Signed)



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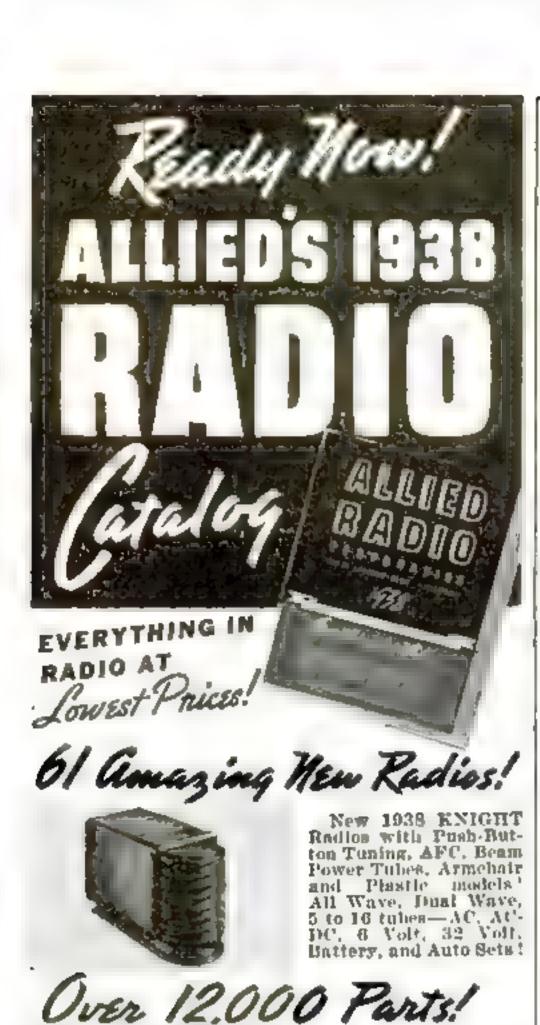
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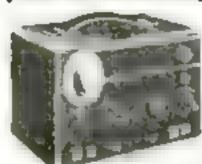


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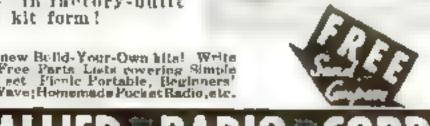


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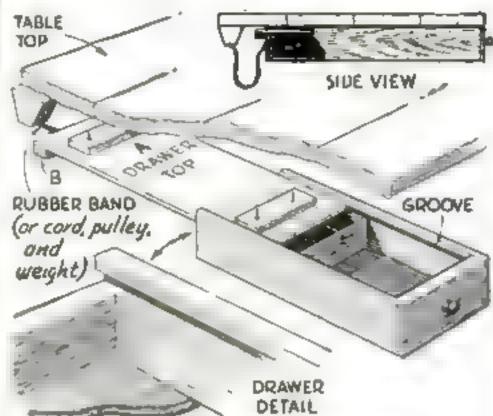
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Drawer for Printing Paper Snaps Shut

AFTER having ruined many sheets of A photo printing paper because I forgot to cover them while making exposures, I devised a lightproof drawer that would snap shut automatically whenever it was used.

The drawer has a groove % in. from the top inside edges of the sides and front. The groove is about ¼ in. deep and wide enough for a sliding fit for the cover A, which is fastened under the table as shown on the next page. Cleat B is fastened to the cover to make it light-tight at the rear when the drawer is in. The cover is made very slightly



The drawer has a special top fastened underneath the table to make it lightproof

Special Paper Holder Speeds Enlarging

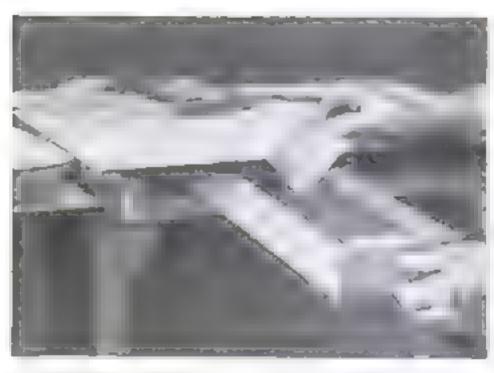
(Continued from page 109)

able thickness under the clamp of the enlarger.

Fasten one of the rulers and the two plain wooden strips to the baseboard with wood screws, as shown. If the bottom edge of the ruler is beveled, the ruler must be used with that side up. Along a line parallel to the ruler and about 1 in. from it, bore a series of small holes about 1/4 in. apart, and whittle a wooden peg to fit them. It is best to paint the baseboard with two coats of flat black paint.

Focusing is done on a sheet of white paper the same size as the intended enlargement, placed on the baseboard so that one edge is under the brass edge of the ruler, and the adjacent edge is against the wooden peg, which is inserted in the hole that about centers the paper on the baseboard. After focusing, remove the paper and, with the wooden strips swung out toward the ends of the baseboard, slip one edge of the enlarging paper under the brass edge of the ruler, sliding it over until it strikes the peg. Then place the other ruler on the paper and draw it slowly away until the edge of the paper is held down by only the brass edge. Hold the ruler in this position and swing the wooden arms in over its ends to keep it in place. For short exposures requiring no dodging, the sliding ruler may be held in place with the fingers, if desired. This makes the operation very speedy.

This paper holder will take enlarging paper up to 8 by 10 in., but a similar one for larger paper can be made by using a larger baseboard and, instead of the rulers, thin hardwood strips each having a 1/16-in, rabbet along one edge of the wood.—G.A.R.



To safeguard the unused paper, this drawer shuts by itself when the handle is released

wider at the back so as to act as a brake when the drawer bangs shut.

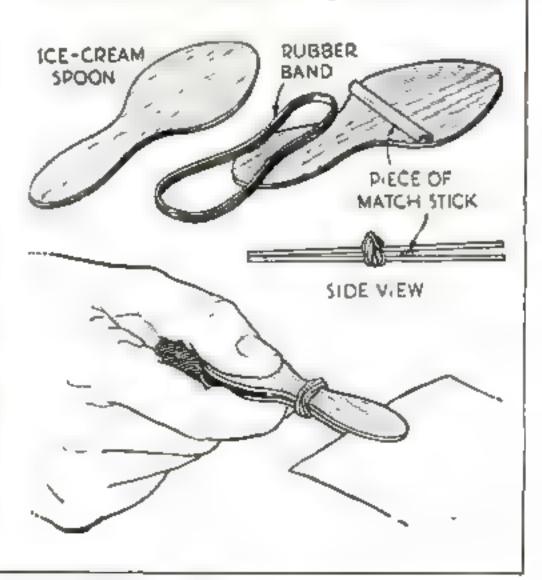
To close the drawer, either a rubber band of suitable length and tension may be used, or a cord passing over a pulley with a weight on the end. I have used both on different occasions and prefer the latter. For the weight, I use a small tin pail with odds and ends of nails, bolts, and scrap iron.

No dimensions are given because the drawer should be made to fill individual needs. Select as light material as possible. If no tool is available for plowing the grooves, cleats or strips may be fastened on the sides to serve the same purpose.—C. A. VEBURG.

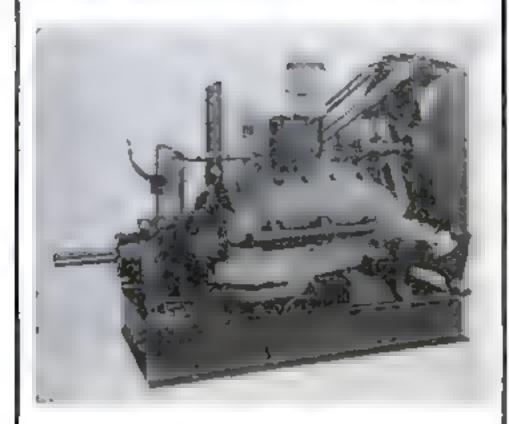


Small Print Tongs Made from Wooden "Spoons"

These print tongs are made in a minute from two wooden ice-cream "spoons," If they are to be kept for permanent use, dip them in melted paraffin.-G. B.



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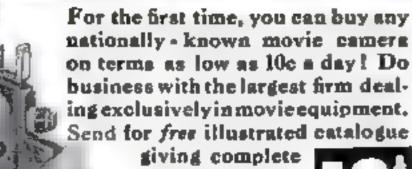
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Aerial Cameras Take Uncle Sam's Picture

(Continued from page 51)

line changes, the points where the water touches the sides of the basin representing the contour line for that particular elevation. By placing the negatives on top of each other, when the job is completed, the Government experts will have a complete contour map of the basin, each line produced by a click of a shutter instead of by weeks of field work.

In other parts of the world, aerial cameras are busy with unusual tasks. Along the shores of the Mediterranean, archæologists are searching for submerged cities of antiquity with sky cameras. In the South, cut-over pine lands are being photographed from aloft to enable a turpentine company to count the stumps and determine whether they are numerous enough to be used as a new source of the valuable oil. Queerest of all new uses in one reported from California. By taking two air pictures from slightly different positions and placing them in a glorified stereopticon, experts can produce a three-dimensional photograph of a gravel pit or quarry and calculate exactly how many cubic feet of earth or stone have been removed!

THESE modern wonders, culminating in the program for air-mapping the whole United States, represent an advance of hardly more than a quarter of a century. It was only twenty-seven years ago that George Parmenter, a Los Angeles newspaper man, rode aloft with Louis Paulhan in a "box-kite" biplane to snap, with a small folding camera, one of the first aerial photographs ever taken in America. The progress since then has been due largely to one man, Sherman M. Fairchild.

Shortly after the World War, Fairchild was sent to Arizona for his health. He turned to his hobby of photography, and in less than a year had developed a high-efficiency between-lens shutter which would work as well at high altitudes as at low. Previous shutters were prone to freeze or stick in the cold of the upper levels. Today, Fairchild cameras are standard equipment for both Government and civil aerial photographers in twenty-one foreign countries as well as in America. In addition to selling more than \$775,000 worth of cameras, in one recent year, Fairchild's company did \$245,000 worth of aerial mapping.

One of the largest jobs it tackled was surveying all of Connecticut, two years ago. This work, done for the state highway department, produced a \$20,000 aerial map composed of 10,479 separate pictures. The completed mosaic measured eighteen feet across the bottom. Made on the same scale and joined in one piece, the air map of the whole United States would stretch for three city blocks and would be as high as a thirty-one-story building!

Fruit Basket Is Ventilated

Peaches now are being shipped in special ventilated baskets designed by experts of the U.S. Department of Agriculture. The baskets are made with open, crown-shaped covers and slotted sides that permit free circulation of air around the fruit, permitting the peaches to be cooled quickly for shipment.

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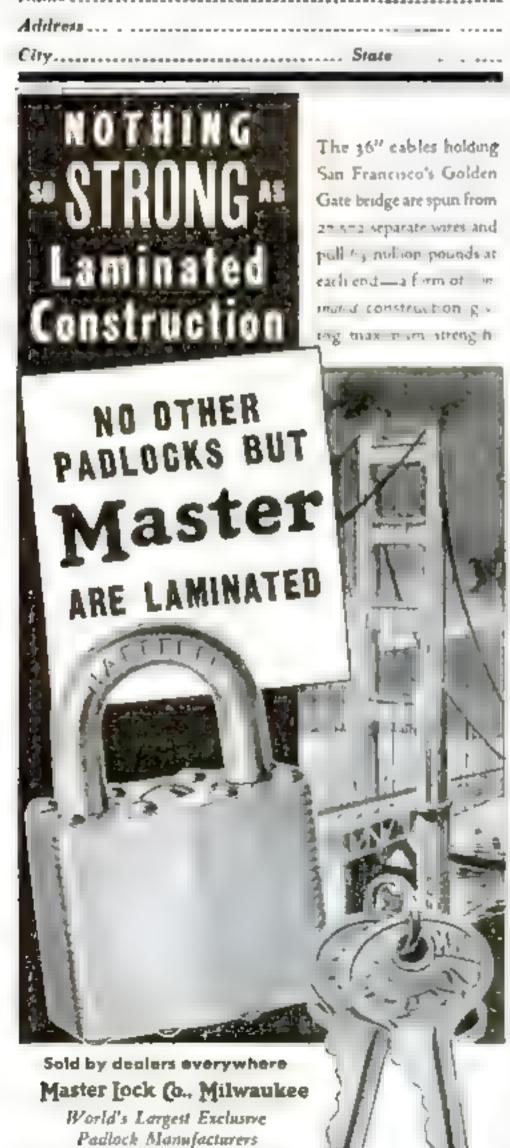
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Making Better Photos of Tiny Objects

(Continued from page 70)

device, one precaution must be taken. Always BLOW-under no circumstances inhale through the mouthpieces. Choose your object, hold it in front of the vapor gun, and blow through the mouthpieces, slowly waving the gun back and forth to obtain an even distribution of the vapor. If the particles of condensation seem to be too thick, a slight blowing of the breath on the object will thin out the particles. On rainy or damp days, if you experience difficulty in getting an even distribution of vapor, pass the object two or three times over an open flame todry off the excess moisture.

After photographing the object, merely blow your breath on it and wipe off with a dry cloth. When you are finished with the vapor gun, pour out the chemicals and wash both bottles and tubes thoroughly with water.

While the vapor gun is

effective for bringing out small details, an added advan- are extended to produce the desired entage is that you may standardize and catalogue your exposure time for future reference. For example, the before-andafter pictures were made with a twelvecentimeter F/4.5 and a 7.2-centimeter F/4.5 lens, depending on the amount of magnification, with the stop set at F/.22; a sixty-watt lamp used for high-lighting was opposed by two twenty-five-watt lamps for softening the shadows. Using a four by five-inch copying camera with commercial orthochromatic film, the photographs were made according to

the following references: 1-power-12 cm. F/4 5, stop F/.22, exp. 10 sec.

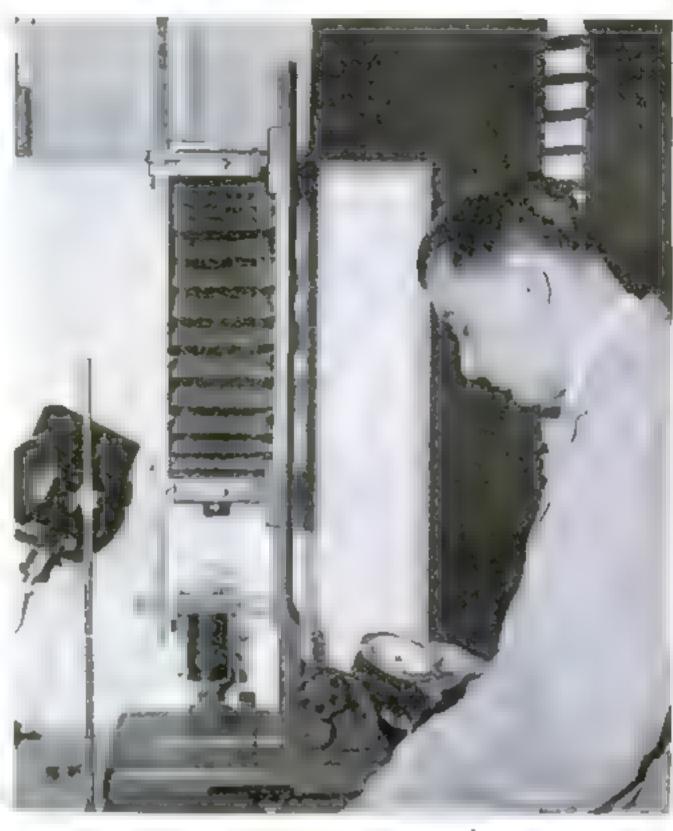
2-power—12 cm, F/4.5, stop F/.22, exp.

4-power-7.2 cm. F/4.5, stop F/.22, exp. 35 sec.

6-power—7.2 cm. F/4.5, stop F/.22, exp. 2 min.

BY USING a fast panchromatic film specially prepared for newspaper photographers, you can figure on stopping your lens down even further and cut the exposure time virtually in half. You also will find that this kind of film gives more detail in the negatives. Unless you can follow the specific directions of development in complete darkness with the developer at sixty-five degrees Fahrenheit, however, it would be wiser to stick to orthochromatic negatives that will not fog under an ordinary red darkroom safe light.

With reference to the camera itself, the rod extending from top to bottom at the left side of the camera fits in with the exposure table, in that it is marked with notches representing magnifications from one to ten-power. By placing the bottom of the camera at zero and the top at a designated number, the bellows



A combination camera and enlarger in use. Note how the object is mounted on the body of a microscope for facusing

largement on the negative. A rough focus is obtained by sliding the entire camera up and down the fixed standard attached at the right of the camera, and the finer focusing is done with the screws in the microscope body holding the platform upon which the object rests while it is being photographed. Exposure can then be governed by slipping the cap on and off the front of the lens or by turning your lighting set-up on and off.

IN CONCLUSION, if the reader, be he l amateur, professional, or laboratory student, with cramped quarters for a darkroom, does not own an enlarger, he can easily transform his copying camera into an efficient enlarging unit.

Basically, the method consists simply of photographing on bromide paper the image on the negative. Merely shoot diffused light through the negative and back through the lens, focus the image on the ground-glass focusing back, and turn the light off, or cap the lens. Then load a holder with bromide paper instead of film and place it in the camera. Finally, remove the slide and expose the paper in the same manner as you would if you were using ordinary film. After exposure, replace the slide in the usual manner and then you are ready to develop the print.

To some photographic enthusiasts, this procedure may seem altogether too complicated. However, when you consider that some amateurs are forced to do their developing in the kitchen sink or in the bath tub, a double-duty camera that takes up the minimum of space can form the basis for a lot of fun as well as many interesting and novel experiments that may later turn out to be of consid-

erable value.

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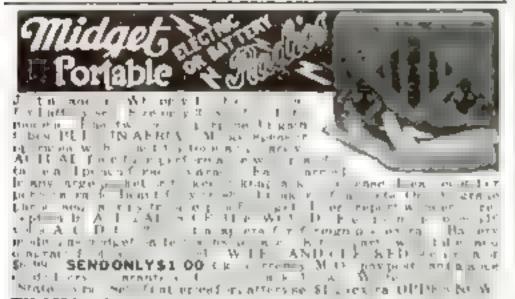
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TINYTONE RADIO CO., PS-9, KEARNEY, NEBRASKA







How the microscope is clamped in position. Its base rests on a platform of sheet aluminum

Hitch a Magic Lantern to Your Microscope

(Continued from page 77)

purchase sockets from an automobileaccessory store. The one shown is double-ended, requiring a bayonet plug at the lower end. Find the position of the socket necessary to expose the lamp filament in the direction of the microscope: and at the rear of the socket fasten, with rivets made from brass escutcheon pins or small nails, an L-shaped piece of brass or iron, measuring in cross section perhaps one-sixteenth by threeeights of an inch. In the projecting part of this piece, drill a hole to receive the screw that clamps it to the adjustable block. If you are employing a 110-volt lamp, insulate the lamp socket from the rest of the projector by using mica washers and an insulating bushing between the socket bracket and the mounting screw as shown in the drawings.

The lamp housing can be made of any kind of metal, and can be of any shape that will provide sufficient shielding, yet allow adequate ventilation. The housing shown was made from two tin cans; one, larger than the other, serves as a cap. A short length of brass tubing, silver-soldered and riveted to the inside of the housing where it will slide over the end of the upright rod when the housing is in position, provides a support. Cut a small hole in the housing so that light from the filament can reach the condensing lenses. The smaller the hole, the better, provided it does not shield the filament.

THE proper condensing system to use for microprojection depends largely on the degree of magnification. For lowpower projection without an eyepiece, and for low powers with an eyepiece, a simple condensing system consisting of a pair of plano-convex lenses, or merely a single spherical condenser lens, can be used. For higher powers, a microscope having a substage condenser should be used; or else an additional condensing lens can be placed very close to the microscope stage. A 7.5-power tripod magnifier lens, or a similar lens from a dissecting microscope, sometimes makes an excellent auxiliary condenser.

For simple projection at low or moderate magnifications, without an eyepiece or with one of moderate power, a
pair of plano-convex condensing lenses
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cost, complete (Continued on page 132)



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A Magic Lantern for Your Microscope

(Continued from page 131)

with mount, less than four dollars. The photographs show these condensers mounted on an upright in such a way that they can be adjusted horizontally and vertically. It was found, however, that only the vertical adjustment is required, provided the lenses are fairly well centered with respect to the bed. Any slight variations can be overcome by adjusting the lamp position. The metal tube in which the lenses are mounted is encircled by a band or sheet brass or tin plate, which in turn is fastened to a brass block, equipped with a set screw, like that employed for the lamp socket. This brass block can be merely a piece of three-quarter-inch rod about one inch long, suitably drilled and tapped.

WATER cell for absorbing radiant heat is desirable when slides likely to be damaged by heat, or live specimens that would be killed by it, are being projected. An easy way of making a cell is shown. Cut two squares of glass, preferably thin plate, and measuring three and a half to four inches on an edge. These pieces press against a Ushaped length of rubber tubing that provides a water-tight seal and at the same time acts as a spacer. To prevent complete collapse of this tube, insert a length of insulated electric cable or wire, or other material. Squeeze the glass tightly against the tube with C clamps and bind the edges securely with adhesive tape. Then you can remove the clamps, and the tape will hold the glass in contact with the rubber. A more satisfactory, but not so simple, method is to construct a pair of wood or metal frames and provide them with bolts and wing nuts so that pressure can be applied to the glass.

The ideal place for a water cell is between the two condenser lenses where the light travels in parallel rays; but the cell works satisfactorily enough when placed between the condensers and the microscope.

For short-range microprojection, say over a distance of five or six feet-adequate for showing slides to a dozen or so persons-you can use polarizing disks. This opens up an extensive additional field, for you can demonstrate with striking effect the remarkable range of colors and patterns produced by chemical crystals and other substances when viewed by polarized light. The polarizing disks, which can be obtained in various forms, are used in pairs, one (the analyzer) over the microscope eyepiece and the other (the polarizer) somewhere in the light beam. The disks illustrated are about two inches in diameter, and were not intended primarily for use with a microscope. It is possible to purchase disk polarizers that drop into the filter rings of standard microscopes, and analyzers that fit over the eyepieces.

THE mountings shown were designed I to adapt the large disks to the projector. The one, holding the disk that polarizes the light before it enters the microscope, is made from a screw-cap cardboard container of the type commonly used for packing small machine parts, medicines, and other commodities. A hole is cut in the cap, which then becomes a threaded ring to clamp the disk against the end of the box. The bottom

is cut off and the box slipped into a sheet-metal ring fastened to an upright clamped to the lathe bed. This ring fits loosely, so that the disk can be rotated to regulate the plane of polarization and to aid in producing color changes and other effects.

The analyzer disk is held over the eyepiece by another box or jar lid with a hole in it to accommodate the eyepiece. A simple wire clip, bent as shown, holds the disk in the lid, yet does not obstruct the light rays.

THE method of mounting the microscope on the lathe bed will vary with the type of base the instrument has. Generally, a rectangular piece of wood or metal can be bolted to the bed, and provided with a wood or metal bar that can be clamped, with a small bolt equipped with a wing nut, across the feet of the instrument. Be sure to adjust the microscope carefully, so that its optical axis is parallel to the lathebed base.

After the microprojector is complete, set it up in a darkened room, adjust the microscope for its lowest power, and clamp a slide against the stage. Move the lamp or the condenser one way or the other, until the image of the filament is formed on the plane of the slide. Focus the microscope until the image is sharp on a screen placed two feet or so away. The illumination probably will still be uneven and poor, but this is remedied by slight readjustment of the condenser or the lamp. Strive for maximum brilliancy of illumination on the screen. To achieve this requires a little patience. Finally, clamp everything rigidly in place, and you will not have to bother much with adjustments after that.

You probably will discover a number of little refinements that will improve the performance of your microprojector. A shield, such as a large disk of cardboard with a hole in it, placed around the microscope tube, will keep stray light from reaching the screen and dimming the image. It you use a microscope having a substage condenser, try the effect of removing the condenser entirely, or of using only the lower lens of it. If your instrument has no substage condenser, try inserting addi-

tional condensing lenses.

AS FOR suitable objects for projecting, A they are unlimited. For entertainment purposes, live specimens such as vinegar eels, creatures found in stagnant pond water, and small insects seem to have the greatest appeal.

For polarized-light projection, try various chemical crystals. A thin layer of crystals formed by evaporating a mixture of copper sulphate and magnesium sulphate on a slide will produce a variety of color. Examine also various hairs, potato starch, and anything else that responds to polarized light. Some objects, such as starch, will not show well beyond a projection distance of a few feet, except with the most intense illumination. Another interesting polarized-light feature is the projection of strain images in celluloid or glass. Clamp a piece of metal tightly against the edge of a draughtsman's celluloid triangle, and see if the resulting strain images are intense enough to show on the screen.

A Steer on Steering

(Continued from page 82)

acting steering gear and he got a blowout on the front wheel while he was going fast. Even with the low-ratio steering, the drag of the flat tire may pull him off the road, and with a quick-acting steering gear he'd be dead certain to

end in the ditch."

"Yeah, I can see how that would work out," Grogan grudgingly admitted, "but it seems a shame that I have to go through so much arm motion just because other fellows aren't strong enough to hold the wheel. Here's an idea! Why doesn't some manufacturer make a 'two-speed' steering gear so you could set it for quick-acting ratio for ordinary running around, and shift to the slow, powerful gearing when you had to park or tear off a bit of speed."

Ous laughed. "And what would happen to the bird who forgot he was set for quick-acting steering when he gave the wheel a yank to swing out and pass a car? He'd likely swing over so far he'd bash the car coming the other way. No, I don't think much of that idea, although you're not the only one who's thought of it.

"Maybe the trouble with you," Gus suggested, "is that you don't know how

to handle a steering wheel."

"You've got a nerve to say that," Grogan protested, "knowing all the years I've been driving a car."

"Maybe I'm wrong," Gus smiled. "How about taking a little drive so you can prove it?"

"I'll show you, all right," snapped

Grogan, "Climb in!"

They started down the road, with Grogan's huge hands gripping the wheel in a conventional position, one on each side about half way up to the top of the rim.

"Suppose you take the next right turn," Gus directed.

As they reached the turn, Grogan swung the wheel a quarter turn to the right, bringing his left hand to the top of the wheel and his right to the bottom. As he reached this position, he let go with his right hand and, grabbing the wheel at the top, pulled it around to the right for another half turn. Then his left hand grasped the wheel at the left side and continued the motion until his hand was at the top. This gave him one complete turn of the steering wheel, which moved the front wheels far enough to make a sharp, right-angle turn.

AS THEY passed the middle of the quarter circle, Grogan went through the same motions in reverse, so that he made six distinct changes with his hands in order to make the turn.

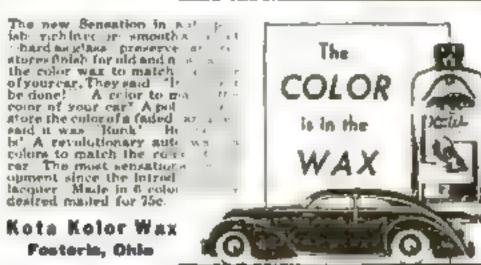
"Lots of fellows do it about like that,"
Gus commented, "and no wonder they
complain about it taking so much motion. Now let me show you how it ought
to be done."

They changed places and continued

down the road.

"Now in the first place," Gus explained as they approached another right-angle corner, "before you get to the place where you are going to turn, place your left hand on the bottom of the wheel if you are going to turn right, or your right hand if you are to turn left. Grasp the wheel like this, with the hand under the rim instead of over it. As you reach the turn, (Continued on page 134)







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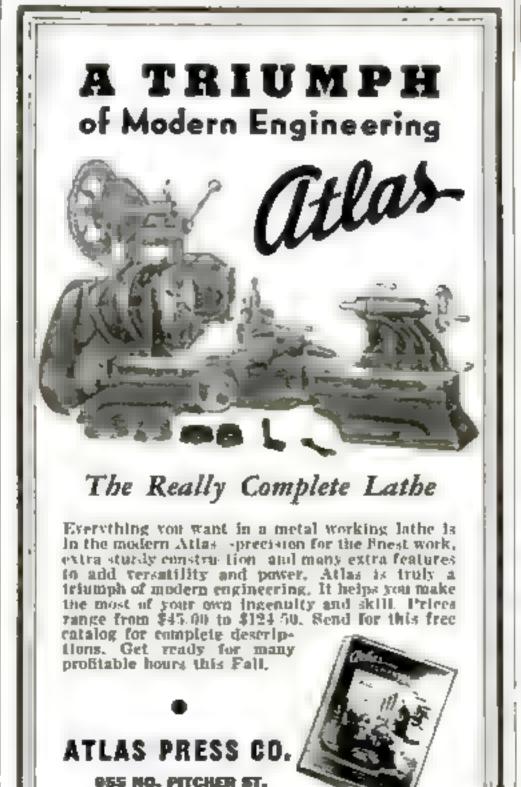
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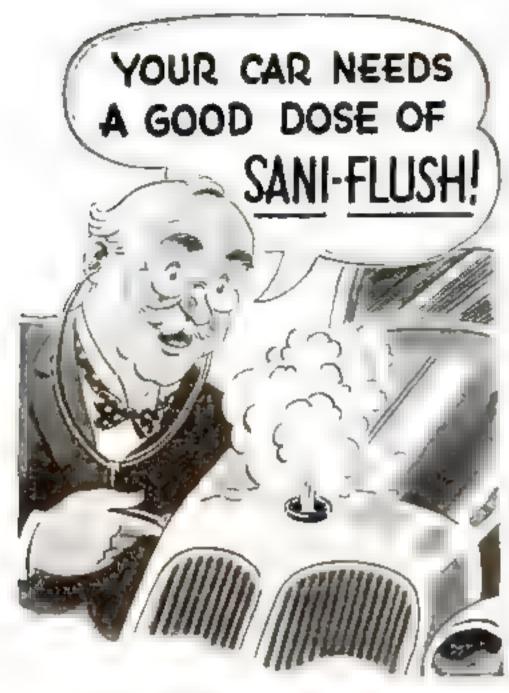
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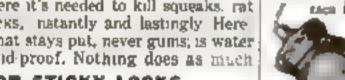
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A Steer on Steering

(Continued from page 133)

swing the wheel around. When your hand reaches the top and starts down the other side, lean your body forward and twist it slightly toward the direction in which you are turning, like this. Doing that makes it possible to swing the wheel till the hand is clear down to the bottom, giving you one complete turn of the steering wheel with one continuous motion. As you pass the peak of the curve, simply reverse the movement of the hand, so that you end up going straight ahead again with only two motions, and no hand shifting at all-except, of course, the one you make before you reach the turn."

"[T'S funny that way of doing it never l occurred to me," Grogan admitted. "I can see that it's all in leaning forward and twisting your body a bit, because, if you didn't do that, you couldn't swing the wheel far enough with one hand. Let me try it."

They changed places again and Grogan steered around several corners by Gus's method.

"It's a perfect cinch going around sharp corners that way," Grogan observed enthusiastically, as his huge hand swung the wheel around to the straight again and they headed back to the garage.

"Did you notice how the wheel swings back to the straight-ahead position by itself?" Gus asked. "All modern cars are made that way. It is called the caster action and is caused by the angle and position of the king-pin with relation to the axle and wheel. On some cars, the action is so strong that you can let go of the wheel at the end of the curve and it will spin back to the straightaway by itself. Some fellows take advantage of that action. They let go of the wheel completely, let it spin most of the way back, and grab it again."

"I've tried it myself," Grogan replied. "It's kind of uncertain, though, and once I nearly walloped a delivery wagon because the wheel didn't turn as fast as usual."

"That's just the point I was going to mention," Gus went on. "The caster action is mighty good thing. The fact that the wheels have a natural tendency to swing to the straight-ahead position makes driving a lot easier. But you shouldn't ever depend on it in close quarters, because the quickness with which the wheels swing back depends on several things, one being how level the road is, figured across.

"THERE'S only one safe way to drive a car. That is, never to let go of the wheel completely while the car is in motion.

"Up to say twenty-five or thirty miles an hour, at least one hand should grip the wheel firmly, and when you're going faster than that, keep both hands on the wheel. If the thumb and forefinger of one of your hands are hooked around a spoke of the wheel, that gives a firm hold without having to grip with much pressure."

Grogan laughed. "Lots of young fellows I know go in for one-hand steering when the right girl is in the car beside them!"

"And take a chance of handing the girl a plaster cast instead of an engagement ring!" Gus growled as he climbed out in front of the Model Garage.



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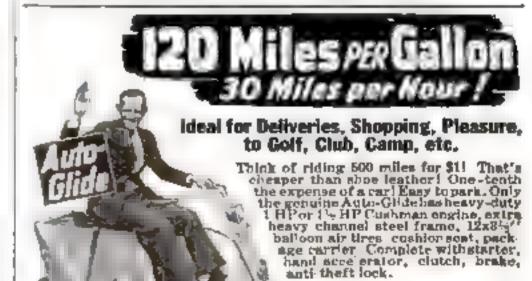
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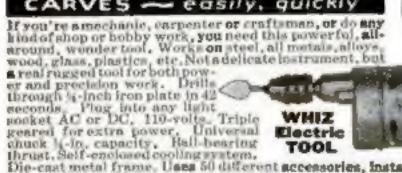
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ENGINE

Stunts With Flames

(Continued from page 73)

p. 44). Steam from the outlet of the redhot copper spiral, for example, will char wood and paper held in the jet, and will make solder, fuse wire, and other alloys of low melting point flow like water. Few would believe that you could light a cigarette with steam, but hold the tip of the cigarette in the stream of burning-hot vapor, take a puff, and the cigarette is lighted.

In the steam-and-magnesium experiment, the steam was "reduced," or deprived of oxygen. You can perform other interesting experiments in reduction, which is the opposite of the chemical process known as "oxidation." by passing a stream of hydrogen or illuminating gas through a heated tube containing copper oxide or iron oxide. A kerosene stove with a flat wick, like the one illustrated, makes an especially handy device for heating tubes and other elongated objects, and can be obtained for less than a dollar.

DASS the hydrogen or illuminating gas slowly through a hot tube containing copper oxide. In a few seconds, you will see the bright color of metallic copper appearing. The oxygen is being extracted from the copper oxide by the hydrogen atoms in the gas, forming water, which condenses at the cool end of the tube. Carbon in the gas also combines with some of the oxygen to form carbon dioxide gas, which passes invisibly out of the end of the tube.

Similar experiments can be performed with a homemade version of what chemists call a "Rose's crucible." Invert an ordinary clay bubble pipe and set the bowl in a porcelain crucible half filled with the oxide to be reduced-say, iron oxide. Fit a disk or square of asbestos paper over the bowl of the pipe to cover the crucible and exclude air as much as possible. Then heat the crucible with a Bunsen burner, while you pass hydrogen or illuminating gas into the stem of the bubble pipe. The hydrogen reduces the oxide, and in fifteen to twenty minutes your crucible should contain metallic iron. Upon examining it when it has cooled, you will find that it is attracted by a magnet.

Oil-Impregnated Bullets Keep Gun Barrel Clean

DESIGNED to prevent fouling of gun barrels, a spongelike bullet has recently been patented by a Hamden, Conn., inventor. Lead bullets foul rifle bores because they build up inside the barrel a coating of lead that is difficult to remove. This fouling can be prevented by coating the bullet with heavy grease before firing it, but the extra operation is messy and unpleasant. The new bullet is made of powdered lead mixed with a substance that turns into gas at a temperature just below the melting point of lead. When the bullets are made, the gases that are formed bubble through the metal and make it porous; the hot bullet is dropped in cold oil and the liquid is soaked up as if by a sponge. When the bullet is fired, the oil is forced to the surface, and lubricates the gun barrel as it passes through to the muzzle. The new sponge bullets, it is said, can be handled without soiling the hands, and are claimed to eliminate fouling of rifle barrels.



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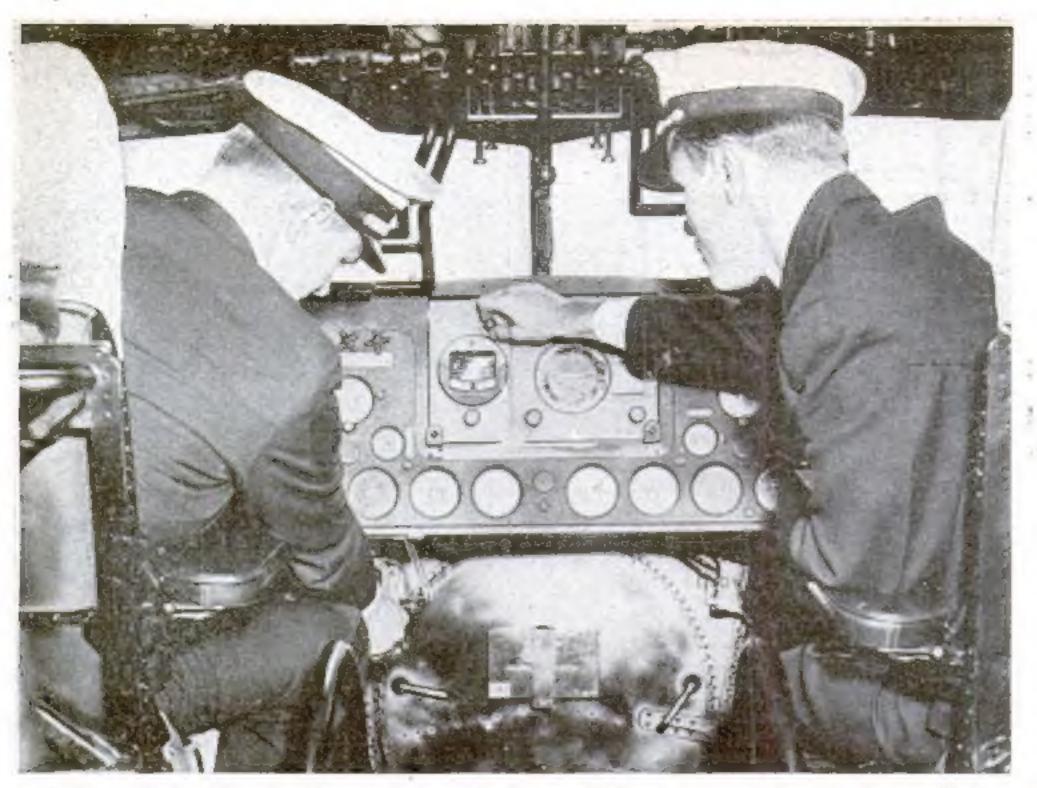
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Race for the Skyways

(Continued from page 27)

operate in flying the "great circle" route blazed eighteen years ago when Capt. John Alcock, a Royal Air Force pilot, and Lieut. Arthur W. Brown, an American, achieved the first nonstop Atlantic crossing from St. Johns, Newfoundland, to Clifden, Ireland, in a Rolls-Roycepowered Vickers-2 biplane.

At the mouth of the River Shannon, in Ireland, and at Ganders Lake, Newfoundland, British interests are establishing terminal bases for the ocean air line. The Newfoundland port, now nearing completion, cost \$3,500,000. Early in July, a joint "experimental" service linked America and Europe when Capt. Harold E. Gray, at the controls of a Sikorsky clipper, headed east from Newfoundland with six companions. At the same time, Capt. A. S. Wilcockson and a crew of four, in the Imperial Airways "Caledonia," Great Britain's entry for aerial honors on the Atlantic, began the "uphill" westward crossing. Neither ship carried passengers or cargo, the flights being trial runs in preparation for the later inauguration of regular service.

With the preliminary flights successfully completed, data gathered by pilots and observers will be studied and plans will be formulated for the inauguration of scheduled runs. It is expected that air-mail service will begin during the coming winter, and by next summer, in all probability, it will be possible for travelers to book plane passage from New York to London.

AGIGANTIC land plane, a DeHaviland "Albatross," built specially for the British Air Ministry, is another transatlantic ship that will fly the Union Jack. Recently, it underwent successful tests at Hatfield, England. A quartet of twelve-cylinder, supercharged engines can drive it at 200-mile-an-hour speeds, and its tanks hold sufficient fuel for a non-stop flight of 3,000 miles. In the air, with landing wheels retracted, the long, cigar-shaped fuselage gives it the appearance of some craft designed for interplanetary travel.

While American and British planes take to the "great circle" route—the path followed by Lindbergh—German seaplanes are making the longer overwater hop between New York and the Azores, the route taken by the NC-4, the U.S. Navy flying boat which made the pioneer flight across the Atlantic in 1919.

LIGHT times this summer, two newtype Deutsche Lufthansa seaplanes, the Nordwind and the Nordmeer, will make round-trip crossings between Horta, in the Azores Islands west of Portugal. and Port Washington, Long Island, N. Y. Four Diesel engines, with a total of 2,400 horsepower, drive the 34,000-pound machines through the air for 3,100 miles with one filling of the tanks. Throughout the ocean crossing, an average speed of about 160 miles an hour can be maintained while the ships are carrying 1,100 pounds of mail. The machines will make the long water jump of 2,390 miles one at a time, starting from opposite ends of the route. During the summer tests, neither mail nor passengers will be transported.

The distinctive feature of the German system is the use of "mother ships" from which the planes are launched. One of the vessels, the "Schwabenland," is anchored off Port Washington; the other, the "Friesenland," is stationed at Horta. Both carry supplies and fuel, as well as cranes for hoisting the seaplanes on deck and catapults for launching them. Compressed air operates the latter devices. The planes are mounted on small sledges which streak down greased rails when the colossal "airgun" is fired, hurling the machines off the deck at flying speed.

On the South Atlantic skyway, where German planes have been carrying mail across the ocean from Bathurst, Africa, to Pernambuco, Brazil, to link Europe and South America, such launching ships have proved of special value. The calms and the humidity of tropical atmospheres frequently combine to make starting from the water almost impossible. Five Lufthansa planes are now carrying the mails across the South Atlantic. Engineers of the company calculate that catapulting the big machines into the air, in many cases, enables them to get away with a ton more of pay load than they could lift if they had to gain flying speed while plowing through the water.

The most radical innovation proposed for use on transoceanic airways is undergoing its initial tests this summer in England. It is the Mayo Composite Aircraft consisting of two machines, a seaplane riding on the back of a powerful flying boat. At the take-off, the seaplane will be loaded to the limit with fuel and cargo, while the flying boat will carry no cargo and only a moderate amount of fuel. Roaring across the water, with its four big engines at full throttle, the boat will gain flying speed and both machines, locked together, will climb into the air. Once aloft, the special locking device holding the seaplane in place will be released and the heavily loaded ship will soar away on the transatlantic run, while the flying boat returns for a landing.

In this unique "pickaback" take-off, Imperial Airways engineers expect to achieve the same results as are now obtained by means of the mother ships of the German air line. During regular runs, the launching plane will fly several hundred miles out to sea while the transatlantic machine conserves its fuel for the rest of the journey. Latest reports from England indicate that both the flying boat and the seaplane have been completed and tested individually in preparation for the first double take-off.

Still another innovation which is being tested in Great Britain's race for supremacy on the ocean airways is a system of refueling in mid-air. The noted long-distance pilot, Sir Alan Cobham, is working with Imperial Airways engineers on a plan which would permit the transatlantic ships to take off with only a small amount of fuel in the tanks and then, while heading out to sea, take on a full load of gasoline from a "nurse ship" soaring overhead.

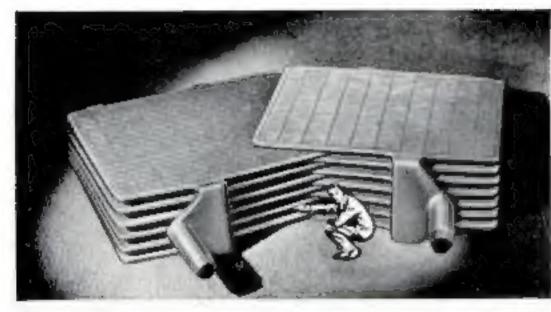
In coming in for a landing, the largest of the aerial merchantmen touch the water at from eighty to ninety miles an hour. Consequently, wide stretches of sheltered water are essential for an ocean terminal. Port Washington, on Long Island Sound, is the aerial transatiantic pier of New York. Here the air-and-water liners of the Imperial Airways, the Pan American Airways and the Deutsche Lufthansa all end their westward flights and take off for their eastward crossings.

LRE, also, on a twice-a-week schedule, the 42,000-pound Sikorsky Bermuda Clipper and the 38,000-pound Short flying boat, Cavalier, are taking off and langing on regular trips between Bermuda and New York. Pan American and Imperial Airways are coöperating in the service. In about five hours, their big ships cover the 783-mile run. Sixteen passengers ride in the English boat, twenty-three in the American.

Besides inaugurating the first aerial service between the islands and New York, the new skyway acts as a training school for men who will pilot long-distance ships now coming from the factories. These fliers will be captains in a new merchant marine of the sky. Sailing over routes now being established, and landing at ports now being laid out, they will link far-away continents in swift and regular systems of transportation.

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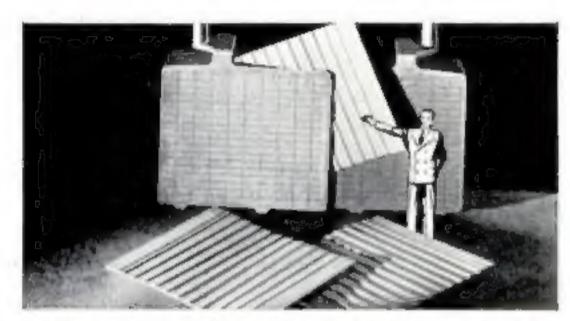
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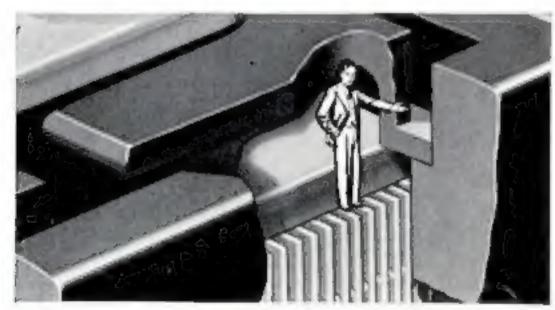
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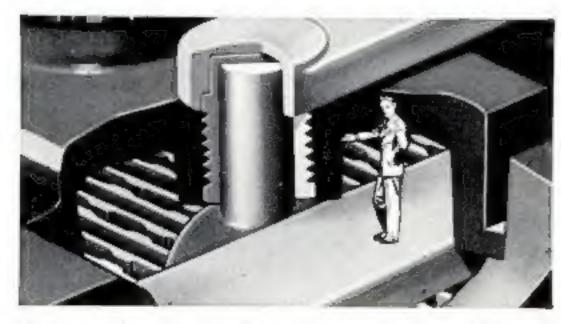
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